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Canadian Field-Naturalist

1915 VOL. XXIX. 1916

THE

OTTAWA NATURALIST

Being Volume XXXI of the

TRANSACTIONS

OF THE

OTTAWA FIELD-NATURALISTS' CLUB

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Organized March, 1879. Incorporated March, 1884.

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THE OTTAWA NATURALIST

VOL. XXIX APRIL, 1915. No. 1

ANNUAL REPORT OF THE OTTAWA FIELD-NATURALISTS' CLUB, 1914-15.

The council of the Ottawa Field-Naturalists' Club, on the completion of another Club year, begs to report on the work during the past season. The work of the Club has been conducted along much the same lines as have been followed in past years and, with some features especially, good progress has been made.

Standing committees, the editor and associate editors of THE OTTAWA NATURALIST, the librarian and excursion leaders, were appointed at the first meeting of the council, held on March 31. Five meetings of the council were held during the year. Fewer meetings than usual were required on account of more work being handled directly by the sub-committees. Connection with other scientific organizations has been maintained through correspondence, exchange of publications and other means. The Club was represented at the meeting of the Royal Society of Canada, held in Montreal, by Dr. C. Gordon Hewitt.

During the year substantial progress has been made in securing new members, 43 being elected, compared with 14 last year. Against this 25 members have resigned or have been removed from the list by death, leaving a net gain of 18. The membership of the Club is now 329. Unfortunately, an unusually large number of members have not paid their dues, which has hampered the work of the Club considerably. At the close of the year there is a balance of $36.25, with some accounts unpaid.

PROTECTION OF BIRDS AROUND OTTAWA.

The arrangements announced in Dr. Hewitt's lecture before the Club on February 10, 1914, (OTTAWA NATURALIST, March, 1914, pp. 161-171), for the distribution of nesting boxes in Rockcliffe Park and the Central Experimental Farm and Botanical Gardens, which areas were declared bird sanctuaries, were carried out in the spring. The Ottawa Improvement Commission instructed their Superintendent, Mr. Stuart, to have 250 nesting boxes of the two sizes recommended made, and these were distributed throughout Rockcliffe Park. The Department of Agriculture purchased and distributed at the Experimental Farm 160 nesting boxes of the Berlepsch pattern of three sizes suitable for birds using such cavity nests, from wrens to flickers. Many of the boxes in Rockcliffe Park were not very suitably hung, which would prevent a large proportion of them from being used, as would otherwise have been the case; nevertheless it was seen that some of the boxes were utilized. Many of the boxes at the Central Experimental Farm were inhabited in spite of the fact that this distribution was unavoidably delayed. Wrens, bluebirds and three swallows were observed making use of them; in one case a box was appropriated by a pair of wrens the day after it was hung.

Before the opening of the spring it is intended to make a complete examination of all the nesting boxes in Rockcliffe Park, and at the Central Experimental Farm, for the purposes of cleaning and ascertaining the number of the boxes occupied during the season of 1914.

Encouraging reports have also been received from private individuals who adopted our recommendation and provided nesting boxes in their gardens. The example that has been set and the educational work since carried on is having very gratifying results in other parts of Eastern Canada.

THE OTTAWA NATURALIST.

The official organ of the Club, THE OTTAWA NATURALIST has appeared regularly during the year. Volume XXVIII, comprising 180 pages, has been completed. Mr. Arthur Gibson has continued to edit it. The following are the most important papers published in the volume:—

"On a new genus and species of carnivorous Dinosaur from the Belly River Formation of Alberta, with a description of the skull of *Stephanosaurus marginatus* from the same horizon." By L. M. Lambe.
"The Waterways of the Mackenzie River Basin." By Charles Camsell.
"Lichens from Vancouver Island. By G. K. Merrill.
"Abscission." By F. E. Lloyd.
"Gall Midges as Forest Insects." By E. P. Felt.
"The Problem of Bird Encouragement." By W. E. Saunders.

"Myosurus in Canada." By E. L. Greene.

"The genus Antennaria in Greenland." By M. P. Porsild.

"Geological Survey Museum Work on Point Pelee." By P. A. Taverner.

"Pleistocene Raised Beaches at Victoria, B.C." By C. F. Newcombe.

"The Snow-flea." By Charles Macnamara.

"List of Tachinidae from the Province of Quebec." By J. D. Tothill.

"The value of some Mammals and Birds as destroyers of Noxious Insects. By Norman Criddle.

"Ceramograptus ruedemanni." By G. H. Hudson.

"The Banded Pocket Mouse, *Perognathus fasciatus* Wied." By Stuart Criddle.

"The New Zealand Peripitus." By E. E. Prince.

"Notes on the Preparatory Stages of *Proserpinus flavofasciata ulalume*." By Arthur Gibson.

"Hybridization in the genus Viola." By M. O. Malte and J. M. Macoun.

"Fauna Ottawaensis: Order Lepidoptera: Family Noctuidae subfamily Phytometrinae." By Arthur Gibson.

"Botanical notes from Portneuf Co., Que." By Bro. M. Victorin.

THE LIBRARY.

During the past year a large number of requests for back numbers of THE OTTAWA NATURALIST have been received. In some instances the current issues were not all received by the members, but in most cases only a few numbers were required to complete volumes.

The Club library is now in a somewhat more satisfactory condition than a year ago. During the year the books and other publications stored in the Carnegie Library were catalogued and systematically arranged on the shelves. The catalogue is now undergoing revision, the most valuable publications being selected and listed for the purpose of publication in THE OTTAWA NATURALIST.

At present no use whatever is being made of the library, but it is hoped that in the near future arrangements will be completed, which will enable members to make some use of the valuable literature belonging to the Club.

EXCURSIONS.

A meeting of the Excursions' Committee, to arrange for the spring excursions, was held in the Carnegie Library on Wednesday, 8th April. There were present Mr. Halkett in the chair, Mr. Carter, Dr. Williams, and Miss Fyles. It was decided to hold excursions as follows, subject to the approval of the council:—

May 2nd—Rockcliffe.
9th—Above the Chaudiere Falls—north shore Ottawa River.
16th—Britannia.
23rd—Ironside.
30th - Leamy's Lake.
June 6th—Rideau Canal by motor boats.
13th—Stittsville.
20th—Fairy Lake *via* Chelsea Road.
27th—Experimental Farm.

Seven of these excursions were held—that on the Rideau Canal being cancelled as no motor-boats could be had, and that to Stittsville also cancelled as arrangements could not be made for the C.P.R. express to stop at that station. There was some misunderstanding, too, as to an early afternoon train up the Gatineau line, so that the excursion arranged to be held at Ironside on 23rd May was postponed until 6th June, and that to Fairy Lake substituted for it.

Two excursions were also held during the autumn—one to McKay's Lake and the other to the Experimental Farm, both of which were well attended.

LECTURES

The series of lectures presented during the winter was also very successful. The attendance was good, and the subjects discussed of much interest. The following is the programme as carried out:—

December 8th, 1914, (Tuesday). "Sea Fisheries of Norway." Illustrated with lantern views. By Dr. J. Hjort, of Norway. In the Normal School Assembly Hall.

January 12th, 1915, (Tuesday). "The Royal Botanic Gardens, Kew." Illustrated with lantern views. By Prof. R. B. Thomson, Botanical Laboratory, University of Toronto. In the Normal School Assembly Hall.

January 26th, 1915, (Tuesday). "The Indians of the West Coast." Illustrated with lantern views. By Dr. Edward Sapir, Department of Anthropology, Geological Survey, Ottawa. In the Normal School Assembly Hall.

February 9th, 1915, (Tuesday). "Fossils." Illustrated with lantern views. By Mr. L. D. Burling, Geological Survey, Ottawa. In the Carnegie Library Assembly Hall.

February 23rd, 1915, (Tuesday). "Milk." Illustrated with lantern views. By Mr. J. H. Grisdale, Director Experimental Farms, Ottawa. In the Normal School Assembly Hall.

March 9th, 1915, (Tuesday). "Some Interesting Canadian Birds." Illustrated with lantern views. By Dr. M. Y. Williams, Geological Survey, Ottawa. In the Carnegie Library Assembly Hall.

March 23rd, 1915, (Tuesday). Annual Meeting and Presidential Address, "The Habits of Insects in Relation to their Control." By Mr. Arthur Gibson, Entomological Branch, Department of Agriculture, Ottawa. In the Carnegie Library Assembly Hall.

THE BOTANICAL BRANCH.

This branch of the Club held seven meetings during the 1914-15 winter season; two each at the residences of Mr. Geo. H. Clark and Mr. R. B. Whyte, and one each at the residences of Mr. D. A. Campbell, Mr. W. T. Macoun and Mr. J. M. Macoun.

At these meetings there was an average attendance of about 14 members. Reports of these meetings are printed in THE OTTAWA NATURALIST. The subjects presented were as follows:

"The Possibilities in Canada for Home Grown Seed," by Messrs G. H. Clark, M. O. Malte and W. T. Macoun.

"Some Canadian Wild Fruits," by J. M. Macoun; "Climatic and Soil Conditions as They Influence Plant Life," with special reference to Canadian Grasses, by M. O. Malte.

"The New Greenhouses at the Experimental Farm" and lantern slides illustrating some "Native Shrubs and Trees," by W. T. Macoun.

"An Account of a Trip to Egypt and Palestine," by R. B. Whyte and lantern slides of "Plant Adaptations," by D. A. Campbell.

"Forestry Problems in Canada," by J. R. Dickson and "Facts regarding the Organization of the Forestry Branch," with lantern slides, by C. J. Tulley.

"Wood Fibre—Its Uses in Pulp and Paper Making," by J. S. Bates, of the Forest Products Laboratories, McGill University, Montreal.

THE ENTOMOLOGICAL BRANCH.

The Entomological Branch has held no meetings during the winter of 1914-15. This has been largely owing to the fact that there are very few workers in entomology, other than those employed officially in the Department of Agriculture.

Throughout the Ottawa district large numbers of insects in the various orders were collected during the season of 1914 for systematic study and many new records have been obtained. Many of these captures are being recorded in the Entomological Record for 1914, which will appear in the annual report of the Entomological Society of Ontario for that year.

ACKNOWLEDGMENTS.

The Club has again been fortunate in securing suitable accommodation for lectures and committee meetings through the courtesy of the management of the Carnegie Public Library and the Normal School, and our thanks are also due to the city press for free insertion of lectures and excursion notices and reports.

Respectfully submitted,

E. D. EDDY,

Secretary.

ERRATUM.

In Mr. Melville Dale's article on "August Bird Life at Pleasant Point, Ont." which appeared in the March (1915) issue of THE OTTAWA NATURALIST, the four paragraphs on page 174 beginning with "The discovery of this bird . . . . " and ending with "within the range of the observer" should have been placed under the Caspian Tern, *Sterna caspia*, and *not* under the Bluebird, *Sialia sialis*. Ornithologists please make note.

SUBSCRIPTION 1915-1916.

Members of the Club are reminded that membership fees for 1915-1916 are now due, and that the same are payable to the new Treasurer, Mr. G. Le Lacheur, Seed Branch, Department of Agriculture, Ottawa.

TREASURER'S STATEMENT 1914-15

Receipts.

Balance from 1913-14		$ 28.59
Membership fees:		
Arrears	$ 16.00	
1914-15	138.00	
1915-16	33.00	
	$ 187.00	
		187.00
Advertisements in The Ottawa Naturalist.		93.90
Authors Extras sold		82.29
Provincial Government Grant		200.00
Miscellaneous		1.43
		$ 593.21

Disbursements.

Printing The Ottawa Naturalist, 8 Nos. of Vol. XXVIII	$ 305.09
Illustrations	27.18
Authors' Extras	92.14
Miscellaneous printing, envelopes, etc	24.30
Postage, The Ottawa Naturalist to members	23.89
Editor	50.00
Lectures expenses	18.00
Postage, bank exchange, etc	16.36
Cr. Balance	36.25
	$ 593.21

Examined and found correct.

J. BALLANTYNE,
E. C. WIGHT.
Auditors.

J. F. WATSON,
Treasurer.

SUGGESTIONS FOR ORNITHOLOGICAL WORK IN CANADA*

By P. A. Taverner,
Geological Survey, Ottawa.

In surveying the results of ornithological work done in the Dominion to date, one is struck with the number of blank spaces in our knowledge, and the fine field yet offered for original research.

In the subject of life-histories, there is hardly a species, amongst our typical Canadian forms, that has been comprehensively worked up. Most of the work accomplished along these lines has been done in the adjoining republic and describes conditions abroad, slightly foreign to us zoologically as well as politically. Of course, our workers have been fewer both actually and proportionally in Canada than in the United States, and perhaps under the circumstances the broader generalizations that our few have accomplished has been of more pressing nature than the detailed surveys accomplished in the older community.

In geographical distribution our knowledge of Canadian avifauna is fragmentary and, if it were not for the results of work accomplished in the United States, would still be but an outline. The Maritime Provinces have been touched but locally. The Labrador and the Gulf of St. Lawrence has been worked intermittently. From Montreal west to the Toronto region but high spots have been touched; in fact, the southern peninsula of Ontario is perhaps the only area of any size in Canada, that has had anything like adequate attention from an ornithological standpoint. From a line east of Georgian bay to the Manitoba boundary we know practically nothing of bird conditions. Continuous systematic work in Manitoba ceased some years ago and the other Prairie Provinces—Saskatchewan and Alberta—have received but desultory attention from visiting naturalists. British Columbia is being investigated in spots but most of its area except locally in the southern portions is a *terra incognita* as far as exact ornithological knowledge is concerned.

In the northern regions, on the Yukon river and some of its tributaries and main highways, considerable work has been done by occasional visitors. Along the route from Lake Athabasca to the mouth of the Mackenzie river various investigations have been conducted from time to time and, considering the accessability of the locality, our records are comparatively full.

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* Published by permission of the Deputy Minister of Mines.

The Arctic coast of Coronation gulf has been, and is being studied. Of Hudson's bay and Ungava we have but scattered notes and short lists. Though considerable geographical exploration has been conducted by various parties amongst the islands of Franklin and the far north, our knowledge of the ornithological conditions there is fragmentary and imperfect.

In economic ornithology, Canada has done little if any original work.

In systematic science our working collections have been, and still are, too small to accomplish anything comparable to the work done on our own forms in the United States, even if we had our natural quota of trained zoologists to use such material to advantage.

Thus, it seems that ornithology in Canada still has most of its history before it, and outside of a few brilliant exceptions the work that should have been done by our own people has been accomplished by naturalists from the United States who have turned their attention in our direction.

The introduction of nature study in our schools and the general interest that has been awakened in allied subjects of late years has not, to date, entirely fulfilled the results expected of it. In fact, reliable observers of ornithological phenomena, both in Canada and the United States, are, perhaps, fewer to-day both numerically and in proportion to population than they were a generation ago. An elementary introduction to nature in our schools has failed to awaken any serious interest in natural problems. General and elevating interest in nature may be more widespread to-day but no ornithologist of marked ability has found his or her avocation or has been developed through these means. Whether this has been the fault of methods pursued, or causes more deep seated, the writer cannot tell. Certainly if, a generation or so ago, when the opportunities for learning even the rudiments of natural history were few and difficult to obtain, naturalists were developed at all, we should expect that to-day when the subjects are taught in every public school and the introduction to the study is almost forced upon large numbers of people, the percentage of serious and enthusiastic workers would be greater. These are the facts; the causes of the apparent failure must be left to pedagogs to argue over.

Does it not seem that Canada has reached that stage in its development where it can take its rightful position in the world as well along ornithological as in other lines?

For many years the Geological Survey of Canada has devoted what attention its limited staff could spare from its numerous other activities towards gathering Dominion ornithological data and there have been a few private investigators that have been observing and noting with commendable industry. With the broadening out of the work of the Geological Survey and its Museum, great impetus should be given to bird work in Canada. Museums are also being started or rejuvenated in the various provinces and the time seems ripe for a general wakening of interests in zoological subjects. To call attention to our shortcomings in data and workers it seems advisable to outline a few fruitful fields of endeavour that can be worked by various individuals whose tastes incline in that direction.

Ornithology can be approached and studied from various sides and by individuals of many different tastes and inclinations. For the general nature lover, interested in birds from a poetic or asthetic standpoint, the study of life-histories offers a most attractive field. Careful watching and observing of feathered friends in their secluded haunts, bloodlessly stalking them with camera and note or sketch-book and divining the hidden secrets of their lives is a pleasure that can be indulged in by all and enjoyed by many. The most common bird of our vicinity is an object worthy of the most careful and painstakin attention. The Wren building in the improvised nesting box in the garden, the Song sparrow of the near-by thicket are both awaiting a careful record of the story of their daily lives. The amount of original, valuable and interesting information, that can be gathered from such homelike sources is almost infinite and unexpected surprises will almost daily repay the close observer. To those whose time and opportunities are limited such birds about home are fruitful. By those with more leisure, greater ambition or ampler opportunities work farther afield may be pursued and species less commonplace can be studied. In fact there is work in this line for everybody of widely divergent taste and situation and even city parks and backyard gardens will amply repay attention.

As a suggestion for investigation, the following outline of problems to be solved may be followed. It is merely suggestive and can be enlarged indefinitely.

Is the species a resident or a migrant?

When does it arrive and leave?

What are the determining influences upon its migrations,—food supply, weather, or does physiological development produce a periodical desire to migrate?

Which individuals come or leave first, male or female, young or old?

Are they mated when they arrive or do they select mates after arrival?

Are there any courtship ceremonies?

What characters seem to determine sexual selection? Vigor? Beauty? Song?

Do the same individuals return year after year to the same localities, and do they mate together annually?

How wide is the local range of the individual, do they keep close to this home area or wander widely?

When, where and how do they nest?

Which sex choses the site?

Which sex builds the nest and how much and in what way do they aid each other?

What seems to be the qualities that they look for in selecting a nesting site?

Do they work on the construction throughout the day or only at regular intervals?

What is the technic of nest building?

Is the technic the result of instinct, experience or memory and does it improve with experience.

Are all individuals of the species equally expert in nest building?

How far can they adjust nest to new materials, situations or conditions?

Is there any change in the routine habits before, during or after nest building?

Are the eggs deposited immediately after the nest is finished?

What is the incubation period?

How many eggs are laid and when, how often, what is a normal set?

Does the egg laying seem under the conscious control of the individual?

What determines the number of eggs,—the size of the nest, the judgment, age or vigor of individual?

How are the eggs brooded, by which sex, do they divide the labor? Are the feathers removed from the abdomen of the brooding bird consciously or do they wear off by friction with the eggs? What is the incubation temperature? How often are the eggs turned by the parent?

How are the eggs protected during exceptionally inclement weather?

This list covers but a short time in the bird's life, but it shows how much can be learned and studied in but one phase of its existence; other moments in the lives of any species are equally interesting.

One of our greatest desiderata is an accurate investigation of distribution of bird life in the Dominion. The uniniated rarely realize how many of the published ranges of our birds are based upon geographic probabilities, a *priori* reasoning or are copied and recopied, from previous writers. Examples are many. A great proportion of our southern Canadian lists give the Northern Hairy woodpecker as the common form and the Eastern Water thrush as ranging to the plains. The fact is, that the first is but a very rare winter visitor to the area, and Grinnell's Water thrush is the common form in the Lake Erie peninsula. Many more such cases could be cited. The only basis acceptable for such determinations are specimens examined by trained experts. Even when the forms are collected, comparison with series of specimens of allied forms is necessary to certainly established its identity. In these we are woefully lacking and still have to depend upon the courtesy and interest of our friends across the line in the separation and substantiation of many difficult forms.

To establish the Canadian ranges of our birds, their migration routes and general status, we need skilled observers at all possible points, to note and collect local data and specimens. Ideally there should be an observer and collection in every county in the Dominion; each keeping track of his own area and comparing and checking it with results from adjoining stations. Provincial Museums should gather up these local details within their sphere of influence and the whole should be amalgamated and correlated by the Dominion authorities, represented by the zoological branch of the Geological Survey at Ottawa. In this way we would have co-operation and series of local collections illustrating intensive work throughout the Dominion.

All such work, however, to be of service must be based upon exact personal knowledge and substantiated in every way possible. We look back to-day upon apparent mistakes made by our predecessors, even those of marked and recognized ability, and wish for data by which to check their statements. The next generation will demand the same of us and with more reason for impatience, if it is absent. Ornithology has advanced and the necessity for substantiating everything is more generally recognized now than in the past.

(*To be continued*)

MEETING OF BOTANICAL BRANCH.

February 5th, 1915, at the residence of Mr. D. A. Campbell. There were present Messrs. Blackadar, Buck, Clark, Dymond, Donaldson, Fryer, Grindley, Honeyman, Lelacheur, Newman, Simpson, Tully, Whyte and the host, Mr. D. A. Campbell.

Mr. R. B. Whyte described his recent trip to Egypt and Palestine, and exhibited interesting specimens, photographs, etc., collected during the trip. Mr. Campbell showed a series of lantern slides, consisting of certain examples of the adaptation of plants to their environment, etc., which are used in his botanical and nature study courses at the Collegiate.

Mr. Whyte, in addition to describing many interesting experiences in Egypt and Palestine, drew attention to places through which they passed en route. Madeira, for instance, the first stopping place, produces large quantities of grapes and sugar canes; Gibraltar, the great fortress; Algiers, the city with beautiful Moorish architecture; Monaco and Monte Carlo, with their unique histories and present tragedies; the trolley-ride to Nice with the blue waters of the Mediterranean, 200 feet below; Naples and Pompeii—all received passing notice. The country between Alexandria and Cairo was described as flat, with canals about a mile apart intersecting it in all directions. The houses, in many cases, are built of mud, and elaborate pumping systems distribute the water to the agricultural land, from which several crops are taken every year. In this district a forage crop, somewhat like alfalfa, known locally as berseem, is produced in great quantities. It is really one of the clovers, and is listed as Egyptian or Alexandrian clover, an annual winter variety used in warm countries where irrigation is practiced. Wheat is also produced in great quatities around Alexandria.

At Cairo, Mr. Whyte found many things of interest in its numerous bazaars and incidentally picked up a new method of buying. At Ghizeh, noted for its pyramids, 14 in all, the canals are far below the level of the Nile. Heliopolis, five miles from Cairo, was the old university city of Egypt. Only an obelisk is now left to mark its site.

From the standpoint of the botanist, there was not very much of great interest in the Nile valley. Only a few weeds or wild flowers had an opportunity of becoming established, owing to the annual overflow of the river. A small iris and a few odd weeds were all that could be found. All the public parks of Egypt, such as those in Cairo, had flower beds, in which were grown popular garden flowers like the annual phlox, verbena, etc., Farm hands in Egypt received from 15c. to 25c. per day.

At Jaffa, the port of entry to Palestine, Mr. Whyte picked the fine flavoured Jaffa oranges. The orange groves extend for about eight miles around the city. Most of the crop is sent to England. A very effective hedge, consisting of a form of cacti is generally used around the orange groves. The country around Jaffa is fairly prosperous. The field crops consist largely of wheat. The flowers of this region are poppy anemones, and cyclamens. many of the latter being as good as our cultivated forms. Thirty miles inland from Jaffa, the country begins to get barren and desolate. Palestine has few trees and in the Jerusalem district the Olive is the only tree. There are a few annual flowers.

Mr. Whyte spent four days in Jerusalem and from there visited such places as Bethlehem. His large collection of picture postcards added interest to the talk.

F. E. B.

EXCURSIONS.

The Excursion Committee of the Club has arranged the following spring excursions :—

May 8—Rockcliffe.
" 15—Iron Mines at Ironside.
" 22—Britannia.
" 29—Aylmer.
June 5—Rideau Canal by Motor Boats.

PRIZES OFFERED FOR COLLECTIONS TO BE MADE DURING 1915

For the best collection of not less than 50 different species of native Canadian deciduous trees and shrubs, illustrating the reproductive, vegetative and dormant stages of the same. Prize valued at $5.00 offered by Miss F. Fyles, Experimental Farm, Ottawa.

For an essay on any topic relating to Canadian Botany—No limit to length. Prize valued at $5.00 offered by Mr. H. T. Gussow, Dominion Botanist, Experimental Farm, Ottawa.

For the best collection of dried specimens of fungi of no less than 100 species. Prize valued at $5.00 offered by Mr. H. T. Gussow, Experimental Farm, Ottawa.

For the best collection of at least 200 species of insects from the Ottawa District, special marks to be given for species attacking garden and field crops. Prize valued at $5.00 offered by Mr. Arthur Gibson, Entomological Branch, Ottawa.

For the first information of a prehistoric village site or cemetery within ten miles of the Victoria Memorial Museum, available for exploration. Prize valued at $5.00 offered by Mr. Harlan I. Smith.

Directions re the making of above collections and further information may be had on application to the donors.

THE OTTAWA NATURALIST

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SUGGESTIONS FOR ORNITHOLOGICAL WORK IN CANADA.

By P. A. Taverner,
Geological Survey, Ottawa.

(Continued from page 18).

The local worker, then, should collect industriously and determine his specimens with accuracy, getting expert opinion whenever necessary. The fact that no one can be equally familiar with all the recognizable forms of every species should be recognized and no hesitation shown in referring to those having greater experience in special directions. It should be the endeavour to study the bird life of the chosen locality thoroughly and no means should be neglected to extend an understanding of conditions in past times as well as present. For this purpose old literature pertaining to the locality should be searched and the accounts verified as far as possible. In fact the compiling of a bibliography of local application is an important line of research. The aim should be to tie up every record, when possible, with an extant and fully confirmed specimen, if not one in the observer's collection, its whereabouts should be noted so that it may be available for future examination and reconsideration. Examination of old collections of stuffed birds in out of the way places and old houses is a fruitful source of information, but the greatest care should be exercised in substantiating the data in connection with them. When there is any doubt whatever on this point the fact should be noted. In fact, to a local faunal list it is better to add a hypothetical list for all species whose occurrence cannot be substantiated by specimens or on equally unimpeachable evidence. A long hypothetical list is often an indication of careful work rather than the contrary.

In collecting, the local student should attempt to gather representative series of all the birds of his area, showing every possible plumage in which they occur in the locality. This means more than single individuals or even pairs, nor is one only of each stage sufficient. Any single individual may be and usually is abnormal in some particular. It is only by a series of several that the average can be established. Freaks, albinos, melanos and other abnormal occurrences are of little general scientific interest, the normal is a much more desirable subject of study.

In gathering up information of specific occurrences the local taxidermist is a man to cultivate, not only to secure specimens but to learn and see what passes through his hands. It is well also to keep in touch with the shooting and sporting fraternity, for they often obtain material of great interest.

The desirable form in which to keep such collections is undoubtedly as dry skins and not stuffed and mounted specimens. The taste for the latter is waning for one thing, and they are otherwise too bulky to house and keep in any number. As the object is the indefinite preservation, the skin is much to be preferred, for the action of dust and light, to say nothing of insect ravages upon mounted specimens, is highly destructive and their life is limited. Besides this, a mounted specimen is not available for the handling necessary for close examination. One hesitates to maltreat a nicely mounted bird to get at hidden characters, that are easily seen in properly made skins.

A word here may be included as to the much vexed question of subspecies and how far it is desirable to recognize and study them. Originally, when the conception ruled that living forms were the result of special creation, a species was considered a fixed quantity, whose limits could be definitely placed. The acceptance of the evolutionary theory of the growth of species from others pre-existing necessitated a rearrangement of our ideas and it was found that what were regarded as permanent types were more or less unstable and that geographic variations occurred, extremes of which when compared without considering intermediate stages, exhibited differences of almost specific value. As all stages of differentiation between these extremes were to be found, it became evident that they must be regarded as evolutionary departures from the specific type and be, in fact, "species in the making," before the connecting sequence between them and the parent stock has been disrupted or broken down to form isolated species.

Our modern system of nomenclature gives each species a binomial name, one term representing the genus to which it belongs and the other the species. As it seemed desirable to apply definite cognomens to geographical variants from the typical form in order to facilitate referring to them, "give them a handle," as it were, a third name was added, making our system a trinomial one and thus carrying out Linneaus' great invention in the spirit in which it was conceived. The result is logical and necessary, but it should be remembered that such geographical races, varieties, subspecies or whatever the student cares to call them are mere divisions of the species and the specific binomial is to be regarded as a collective name, including all the trinomial variants within its meaning. Thus a "Western Robin" is as much an "American Robin" as the "Eastern one" and the name *Planesticus migratorius* is equally applicable to any of the forms into which the "American Robin." divides. It is in fact only necessary to name subspecies either vernacularly or scientifically where special exactness is required by context or scope of consideration. In any event, it is wiser to ignore it altogether unless there is definite and accurate knowledge for justification. Subspecific designation should only be based upon examinations and authoritative determination of specimens, and not upon probabilities or assumptions.

In every subspecifically divided form there is one race that is called the "type form," loosely called the "species;" this is scientifically named by repeating the specific name in the trinomial; as, the Eastern Robin, *Planesticus migratorius migratorius*. Theoretically this should represent the original stock from which the variants departed but as these are often impossible to determine and scientific nomenclature must be exact, it means in practice that this form is the one that was first discovered or described and to which, by the canons of nomenclature, the name must permanently adhere. The type race then, is really of no more scientific importance than its co-races.

The realization of the proper relative importance between type and subspecific forms and the applications of sane principles in practice will go far towards rectifying the abuses from which a valuable system has suffered.

Some subspecies are marked and conspicuous in character; but as there must be species in all stages of making, some exhibit but minute differences only evident from the examination of series of comparable material by trained perception and judgment.

Theoretically, the numbers of subspecies of a widely varying race must be innumerable, but the most of them are too fine for human recognition. The question is, of course, where to draw the line. Subspecies are actual facts and do exist. Whether it is serving the best interests of science to deferentiate and name the finer variations that only an expert, especially trained, can recognize is a subject, that is still being argued. However, whether we hold with the "Splitters" or the "Lumpers" it seems best for the majority of us to follow the lead, perhaps under protest, of the consensus of representative opinion as evidenced by our American Ornithological Union Check List, though we can reserve to ourselves the liberty of departing from their findings in cases where mature judgment or data justifies it. However, for the sake of uniformity it is better to err on the conventional rather than the radical side and to keep as largely as possible in harmony with accepted contemporary authorities.

Others, to the contrary, notwithstanding no enduring faunal work, can be accomplished without the collection of specimens. The field-glass and camera are most valuable auxiliaries, but cannot altogether take the place of a bird in the hand. Due regard must, however, be given to the principles of humanity. Collecting is a necessary evil to scientific study and is amply justified by it, but the responsibility of the collector is great and his influence should be always thrown against the useless killing of anything. The collector kills for a good and sufficient reason and should never do it, without that justification. Man, who has been given or has assumed the rights of the earth, should recognize his responsibilities and bear the relation of a guardian to harmless lower life. Our laws recognize this and it is necessary for a collector to get a permit from the game warden of his province. This, however, is issued to duly qualified students who should be careful that the privilege is not abused. Nothing should be killed without a good and sufficient reason and when so killed particular care should be exercised that the best use possible is made of it and that it is preserved for all times.

The privilege to collect specimens, the legal property of the people, is granted by the representatives of the people for the benefit and increase of knowledge of the people. Hence such specimens are in a manner public trusts and when once taken should be preserved as such and not for individual gain or hoarding. They should be kept as safely from damage by time, dust, light, insects or accident as circumstances permit and, as the owner has morally but a life interest in them, arrangements should be perfected, so they may be for the present available for study by other workers and finally deposited in some known repository where they will be available to coming generations of investigators.

The fear that the legitimate collector will deplete our bird life is groundless. Even were the number of our collectors increased many times and stimulated to greatly increased energy they would have a negligible effect. Large collections are sometimes pointed to as causes of a supposed reduction in bird life but all the collections in North America, the results of fifty years industrious work, would not nearly equal the destruction caused in one year by millinery plumage hunters. When we consider the constant, widespread persecution and the number of widely distributed sportsmen it has taken to reduce our game birds, it is obvious that a few scattered collectors can have little, if any, influence upon the bird population. The ideal conditions suggested before, call for a collector in every county. If we had but one dozen sportsmen shooters in every county would game be scarce to-day?

There is also a sentiment against the scientist collecting "rare birds" on the supposition that if these were allowed to breed they would become common. There are practically no birds, but game, raptorial and plumage forms, that suffer systematic persecution. The number of small or rare birds that are killed by human agencies, except for profit or food, is on the average negligible. Are there a dozen people in Canada, seeking or hunting for Cory's Least Bittern? How many would know one if they saw it? The species has had hundreds of generations in which to become common, if they are rare now it is due to the action of still operating natural causes. The rarity of a creature not especially or generally hunted for profit is an indication that it is not adapted to conditions and is nearing extinction through natural causes. Rarity obviously just precedes extinction.

Of course with species that are much hunted, or that are rare, owing to the geographical limitations of the habitable or breeding ranges, the question is different. Scientific collectors have occasionally gone into small, isolated colonies and practically wiped out a species that, but for them, might have survived for a while longer. But even in these cases the fact of such limited range itself indicates that the species is declining and its end has been only hastened. A dominant, virile race will tend continually to spread; that it has not done so, it is an indication of inherent weakness in the species.

The Passenger Pigeon is often pointed out as an example of man's ruthlessness, and a great deal of sentimentality has been exercised over it. In the first place, great flocks of birds of this species would to-day be incompatible with agricultural pursuits. If man destroyed the Passenger Pigeon it was by extensive netting operations against them and not by the desultory shooting of scattered farmers and sportsmen. Yet the last year of netting at the Petosky rookeries left countless pigeons alive. The fact that few of these returned the next spring was no fault of the trappers. For years thereafter occasional flocks and bunches of Passenger Pigeons were seen;

enough to have stocked the continent, at any rate to the limit of economic safety, had they been adapted to present conditions. The Bluebird population was almost entirely wiped out one winter. Fewer were left of them than of pigeons just after the Petosky rookery was deserted; yet in five years the Bluebird regained its old numbers. But the Bluebird is a strong, virile race, suitably adapted to the conditions of a cultivated country. The pigeon was not; hence it passed away while its close relative, the Morning Dove, still thrives and increases.

It must be borne in mind that our bird population is limited by natural conditions. In most cases this limit was reached long ago, and no more birds can inhabit North America than can find support during the season of least food supply. In a normal or stationary population, the death rate must equal the birth rate or else the population ceases to be stationary. The breeding season increases the population enormously and one way or another this increase must be, and is, reduced to the smaller supporting power of the land through winter.

It is evident that this allows of a considerable margin of reduction and shows that even quite considerable numbers can be destroyed without interfering with the ultimate numbers of the population and that the comparatively few individuals taken by collectors cannot have an appreciable effect upon their number.

The professional collector has come in for popular abuse, far beyond his deserts. In the first place, the professional collector is almost an unknown quantity. He is too scarce in fact to find when wanted. In the next place, there is little or no market for his wares. Few scientists are wealthy or able to pay prices that allow the professional a livelihood. The trade in big game heads and trophies with wealthy sportsmen is considerable and the plumage business for millinery purposes has wrought devastation amongst certain species but the opportunities for professional scientific collectors are small indeed. This is to be regretted as, allowing that the study of birds is justifiable, it follows, as a matter of course, that the man who supplies the material is justified also and is engaged in commendable work. No one person can personally gather material from everywhere, yet extra-limital material is just what the serious investigator requires in his work. Without a system whereby the earnest student can, at least partially, pay the expenses of his explorations, modern science would still be in the dark condition of middle ages. The epoch making field works of Bates or Wallace would have been impossible if they had not found a market for their wares.

To hope that each of our counties will have facilities for the proper and safe storage for such valuable objects is perhaps to wish for the millennium. However, many of the provinces are establishing museums, that should develop into just such repositories for provincial data and we hope the time is not distant when this use of them will be more highly and scientifically developed. In the meantime we have a Dominion Museum, that is prepared not only to store but to scientifically use such material and is slowly building up a national collection for future Canadian students in proportion with the growing dignity of the country it represents. It is to be hoped that the time will come when it will take equal rank with other national museums of the world, the British Museum, the Smithsonian Institute and others of like repute. To do so, however, requires the co-operation and sympathy of the Canadian people as a whole. No public institution can do all the necessary work itself but must rely largely in the building up of its collections and prestige upon the interest and aid of the people it represents. Thus grew the great British Museum through the practical help of its private friends into an institution that is an imperial pride. On this side of the water the scientific and enthusiastic generosity of such men as Roosevelt, Abbot and others who donate large collections resulting from their sporting expeditions at home and in various parts of the world to the public good, as represented by their national institutions, has gone far to place the Smithsonian Institution well into the forefront of scientific progress. Our people should be no less interested in the advancement of our institutions than those abroad are to theirs. The government alone can never raise its museums to a commanding position in the world; the people in their private character as individuals only can bring about that consummation and with them the future of zoological science rests in Canada, as well as elsewhere.

On the economic side of ornithology much work remains to be done. So far we have been content to draw from the results of the United States Biological Survey and other workers across the international boundary. In so far as they treat of our species, their problems are our problems and it is questionable whether we want to duplicate their work. They have already developed an elaborate technical staff of specialists and special facilities besides gathering an immense amount of material and data. We could not compete with their efficiency for many years. It seems, except in the case of special problems of peculiar Canadian interest, we can do better by leaving the bulk of such investigation to them, co-operating when possible and helping when we can, secure in the knowledge that any results arrived at in Washington are applicable here and available for our use. In the meantime we will have our hands and time free for other original work and avoid unnecessary and wasteful duplication.

Systematic zoology is pre-eminently the work of the closet naturalist and though to the laity it is the proverbial dry-as-dust work of the naturalist of caracture it ultimately underlies our whole modern conception of life. The tracing out of the relationships of species is our means of retracing the chain of life back through the ages to its beginnings. The conditions under which development arises gives us clues by which we are beginning to understand the fundamental principles of living creation. It is work, however, for the specially trained and can only be successfully engaged in after considerable experiences and preparatory study. In the ornithological field, so far, Canada has been too busy with practical development to give much attention to this field of endeavour. For the present, therefore, we cannot hope to seriously compete with older countries who have already trained their staffs and where collections represent material in series such as ours do not as yet contain.

However, we can all do our mite towards preparing the country for future work and future needs, gather data and specimens and gradually train a scientific body competent to attack the "riddles of existence" from the ornithological side as well as from other directions. We are all searching for the truth, the biologist, the geologist, the physicist, the chemist and the astronomer. Far apart as we seem to be in our work, we are all attacking the one great question from different directions. The answer to an astronomical detail is often found by the geologist or the chemist and the geologist receives illumination from the physicist and the biologist.

It is not an overstatement to say that zoology has had more to do with the development of modern thought in its various branches than any other science. The enunciation of the evolutionary theory had a more fundamental effect upon current thought and conception of life than anything that ever went before it. Ornithology is a branch of biology and has done its honorable share in making the intellectual world what it is to-day. If we, as ornithologists labor and do our work conscientiously, with due appreciation of our responsibilities both to science and to mankind, we can shed the light of our individual tapers in some of the dark places and add our quota to the general enlightenment. In the foregoing I have attempted to outline or indicate a course for such work.

MEETINGS OF THE BOTANICAL BRANCH.

February 20th, 1915, at the residence of Mr. R. B. Whyte. Mr. J. R. Dickson, of the Forestry Branch, spoke on the subject "Forestry in Canada." Mr. Tulley, of the same Branch, also gave a synopsis of the administrative data relating to the Forestry Branch and showed a series of very interesting lantern slides, illustrating forestry problems.

Mr. Dickson aptly emphasized the inconceivable quantities of timber used each year in Canada by pointing out that the railway companies used one hundred and fifty millions of ties each year, that the 1911 cut was five billion feet board measure, and other facts involving stupendous figures. In a condensed yet clear and forceful way, he touched on most of the great subjects comprehended in the term "forestry," forestry, as he decribed it, being "The Parent of Industries."

He stated that information available shows that on 60% of the cropable land, timber can be more profitably grown than farm crops. The science of forest management seeks first to ensure the permanence of the lumbering industry, and, secondly, to gain the many other auxiliary benefits, which nourish the life of a nation. The fundamental importance of wood in nearly all phases of industrial life was emphasized. At present, there is a very small stand of merchantable timber in the so-called "Great Northern Spruce Forest," the mature timber having been nearly all swept away by repeated fires during the past century. An analogous condition exists in our southern hardwood belt—but due to cutting rather than fire. Last year some 60% of the hardwood used in Canadian woodworking industries was imported.

It was pointed out that the main elements of a forest policy for Canada must be:

(1) Education of public opinion in order to provide the authority, the money, the driving power.

(2) Classification, according to its producing capacity, of all publicly owned land, to provide for permanence of use.

(3) A plan of cordial and mutually profitable co-operation on an equitable basis of duties and rewards.

(4) Organization on a strictly non-partisan basis, of a trained and efficient forest service personnel.

(5) Provision and equipment for investigation and research work relating to forest problems.

(6) Whatever legislation may be required to place trained men in charge of our forest lands, and insure uniform requirements from every forest user.

Reference was also made to the relation of the forest to stream flow as affecting domestic supply, irrigation and water-power, municipal and city forestry, and the immense wealth of fish and game in Canadian forests.

Mr. Tully, in dealing with the administrative side of the work, stated that there were thirty-one organized Forest Reserves, under the control of the Branch, each in direct charge of a trained forester. The area covered by these reserves was 43,800 square miles. In addition to these reserves, there were Fire-ranging Districts and two Forestry Stations, from which young forest trees, etc., were distributed to settlers in the Prairie Provinces. One of these stations was at Indian Head and the other at Sutherland. From the former over three million young trees were distributed in 1914. The Branch also had research laboratories at McGill University, where problems relating to the products from forest timber of all sorts were dealt with by trained investigators. Those present were:—

Messrs. Attwood, Buck, Campbell, Clark, Dickson, Eddy, Fryer, Honeyman, Lelacheur, Newman, Tulley and Whyte.

F. E. B.

March 13th, at the residence of Mr. Geo. H. Clark. Dr. J. S. Bates, Superintendent of the Forestry Products Laboratory for Canada, at McGill University, Montreal, dealt with the subject "Wood Fibre, Its uses in Pulp and Paper Making." The subject was handled in a very able and thorough manner and was made still more educative by a series of well prepared lantern slides illustrating the fibres of various woods and the pulp making process in the mills.

Mr. Clark, the host, in introducing the speaker, assured him that the members appreciated his coming from Montreal for the purpose of addressing the Club and to Mr. D. A. Campbell also thanks were due for arranging Dr. Bates' trip for this purpose.

After referring to the botanical classification of the principal and minor trees and many varied plants, which were used, or could be used, in the manufacture of paper, and the history of the various processes of making forest timber into paper, Dr. Bates stated that at the present time it cost about two cents per pound to manufacture paper from the forest timber, or stated in another way, forest timber suitable for paper making realized, when sold as paper, the equivalent that it would if sold as lumber at $40.00 per 1,000 feet board measure. There were about 70 factories in Canada manufacturing pulp and paper. About 50 per cent of the lumber cut for this purpose was shipped out of the country as pulp wood, and of the 50 per cent made into pulp, one-third of that was also shipped as pulp, the remaining two-thirds being manufactured into paper in Canada.

There were four main processes of manufacture, and some minor processes, which were not commercially profitable. The beginning of the manufacture of paper, from wood, dated from about 1863, and the new extensive sulphite process from about 1883. The reason why forest timber could be used to such advantage in paper making was due to the fact of the relative shortness of its fibre. The length of fibre in the Black and Balsam Spruce was better for the manufacture of news print paper than it was in the other woods of the forest. Black Spruce contributed 70 per cent of the pulp used for this purpose and Balsam Spruce about 25 per cent. In addition other conifers such as the Jack Pine and Hemlock Spruce were also used in limited quantities, as also were Poplars and Basswood among deciduous trees. The conifers were easily amenable to the chemical treatment necessary in paper making, while the Black Spruce and Balsam were the two which were also very easily bleached. The lignin, which is in larger proportion in some woods than in others, is the cause of discoloration. The chemical process, used to reduce spruce wood, dissolves out most of the lignin, leaving the 65 per cent of cellulose, which spruce contains, available for paper. In one process an alkaline solution is used by which the gums, resins, etc., of the woods are dissolved out.

By means of the several chemical processes now used the best quality of paper is made. The large proportion of 54 per cent of the total, however, is made from mechanically ground pulp in which the lignin, etc., still remains. In many cases this mechanically made pulp is mixed with a smaller percentage of chemically treated pulp, which then gives a paper of better color and quality.

The sulphite is the most important of the chemical processes. This process is one which uses a liquor, made by burning sulphur etc., in which the pulp wood is cooked. The chemical reactions which result, involves the ketone compounds, which unite with the sulphur and separate from the cellulose. The wood previous to the ten hour's cooking is barked and chopped into small blocks. In addition to the sulphite process the sulphate and the soda processes are also used in the manufacture of pulp-wood into paper. Craft or brown and all unbleached papers are made by a soda and sulphide process.

Those present were:—Messrs. Bartlett, Buck, Blackader, D. A. Campbell, R. H. Campbell, Dexter, Dickson, Eddy, Grindley, Low, Lawler, Masters, Rice, Robertson, Tulley, and the host, Mr. Geo. H. Clark. F. E. B.

NOTE ON A WOUNDED DEER.

On December 1st, 1914, the writer shot a male deer, the condition of which, owing to strange circumstances, seems worthy of record.

The animal, a Mule deer (*Odocoileus hemionus*) had been wounded, the wound being inflicted almost surely the previous year. The bullet had entered from the right side and penetrated the flesh of both hind legs, just missing the bones, and in passing through had destroyed the genital glands. Owing to the injury to the muscels both legs were slightly drawn up behind and appeared somewhat stiff, otherwise the deer was as active and healthy as any other.

While this animal had in every respect, but one, made a perfect recovery, it presented, nevertheless, several abnormal conditions. For instance, the deer was unusually large, weighing when "dressed" 184 pounds; it also appeared far more like a doe than a buck. This was particularly noticeable in the neck which had lost all that strong muscular appearance, so characteristic of a stag, the neck, instead, being slender and doe-like. Lastly, the horns are much aborted. Close to the head is a club-like excrescence from which several points protrude. The main points, one on each side, are about ten inches long without branches, the remaining ones, consisting of two on one side of the head and five on the other, vary from mere knobs to points of five inches in length. One of the most interesting features connected with these horns is their immature condition, for while it was December, when all normal horns had long since become hard, these were still soft and in the "velvet," that is to say, still covered with short, more or less wiry, gray hairs. The horns appeared, also, to be still growing, this being evident from the fact that in falling the animal had broken one of the points, from which blood trickled.

From the general appearance of the deer, taking into consideration its size and the condition of its teeth, I am convinced that it was at least five years old, probably older. The immature conditions of the horns were doubtless due, in part, to the wounds having taken many weeks to heal; while their crumpled abnormal shape and the unusual condition of the animal generally would be directly due to the nature of the wound.

This deer was extremely fat and the venison unusually sweet and juicy.

STUART CRIDDLE, TREESBANK, MAN.

A CHEAP CASE FOR SMALL MUSEUMS.

BY HARLAN I. SMITH.
Geological Survey, Ottawa.

For many years we have heard complaints from museum curators and others interested in museums, that there was not sufficient money available for the purchase of specimens, the erection of a desired building, and the making of cases. It is true this complaint was not always, though often, made as a sort of apology for the lack of arrangement and labelling, the presence of dirt, and the failure of the museum to be useful to the community, or even interesting to the average visitor. Some museums spend for specimens thousands of dollars annually, for many years in succession, while their exhibition halls lack sufficient labels of all kinds, and especially the general divisional labels and case labels which are among the first needed to make a museum useful to the public. It is like paying $5.00 for a volume and not reading it when it were better to buy a five cent book to read. It is known by actual experience that a few hundred dollars invested in lumber, stain and the services of a painter, will remove this main stigma of faulty labelling from a fairly large museum. After all, a museum had better be without many specimens than to be lacking in essential labels. One specimen, such as a diamond or an elephant, may cost more than thousands of equally instructive specimens, such as a piece of coal or a kernel of corn, and will actually use up funds needed to completely label a large part of a great museum or an entire small one. Many institutions waste years in discussing what color, and weight of cardboard, or other material is to be used for labels, and many years pass before any exhibit is adequately labelled; it would be better to attach labels—either written in longhand, or by typewriter, so that the present generation may get useful service from the exhibit. Such tentative labels may be replaced whenever a better kind is decided upon.

Waiting for a fire-proof, or permanent, or larger building is certainly a waste of time. I once knew of a professor who complained that he could not teach a number of interested students because he had no class room, but I believe I can recall hearing of certain great teachers of antiquity, who taught their disciples by the road side, without either class room or place to lay their heads, and this idea also applies to museums, for after all, the whole out-of-doors is the best museum. A corner in every school-house may be a museum; a nook in every Board of Trade building may serve the same purpose; even the Sunday

School room may have its museum. A cheap inflammable building may be a more useful museum building than a fire-proof structure costing millions. In an inflammable building it would not be wise to store valuable material, but in it could be displayed labels, pictures, maps and books illustrated by such cheap and common specimens as elm leaves, squash seeds, broken pebbles, English sparrows, mice, or the skull of a dog. A museum of such specimens, accompanied by appropriate labels, books, maps, pictures and models, might easily be of more service to a community than some existing museums costing say ten times as much.

Case problems may delay curators not months but years. First there is the discussion as to what kind of a case and how to make it dust proof; what it should be made of, the color the back-ground is to be painted, or whether burlap will be used instead of paint. In this way, while waiting for cases, years go by. People who would use the museum grow old and die. Children who have time in their receptive condition of mind to profit most in the museum grow up and have their time occupied by necessary labor. Their minds become blunted to the useful impressions which they might gain in the museum, and still the museum curator has not secured the case he needs for the exhibit in time to benefit all the classes of people, from the old people to the school children. As a matter of fact, all these people could have gotten the maximum amount of benefit from the museum, had the specimens been exhibited without any case at all, on the wall, on tables, on the floor, or even out in the big out-door world, had there been sufficient and appropriate labelling. Thus the kind of material and color of case seems to have little to do with the usefulness of a museum. I have seen museums with black cases, white cases, reddish cases, yellowish cases and portions of museums with no cases at all, and every one of these had some exhibits that were superior in graphic usefulness to some class of the public than were any other exhibits known to me. No doubt the back-grounds should be carefully considered, certain colors being better than others. Perhaps the relationship of colors or general harmony and the relationship of light and a subdued quietness of color are of extreme importance, but visitors have been in a museum where the cases were entirely white, been interested and obtained useful information some little time before noticing whether the cases were white or black. While black cases may not be advisable, several of our best museums have them, and in some instances one sees the exhibit before it is realized that the case is black. No doubt either a white or a black case may be very bad in a wrong setting, wrong relations, or if it is not harmonious, and not used wisely.

The museum of the Natural History Society of New Brunswick, located at St. John, has a comparatively small amount of money to spend each year. In this the museum is perhaps fortunate, for in so far as the curator's funds permit, some of the most up-to-date museum methods are actually being put in force. The curator has insufficient help, a comparatively poor building and miserable cases, yet he carries on field research, conducts a lecture course for adults and one for school children, so that two lectures are given each week during the school season. Large parties of young people are taken out to investigate and study in the field; some publications are issued, material collected by school children and sent to him by their teachers is identified, and the teachers of the schools are provided with nature study leaflets suggested by the object sent within twenty-four hours of its receipt. Every school child is interested in what Willie Jones of School No. 2 found yesterday.

In autumn when the Canadian Pacific Railway supplies two cars to be drawn over its lines and side tracked for a few hours,more or less, at each station.where an audience may be had, and when these cars are filled with exhibits under the auspices of the Provincial Government of New Brunswick, the curator accompanies the train. One of the cars usually contains exhibits of pigs, chickens and other live stock; other exhibits relating to agriculture consist of bees, nursery trees, cream separators, or whatever the Government experts consider may uplift the agriculture of the Province. Our curator friend installs material from his museum, supplemented by specimens collected for the purpose. Specimens of birds which benefit the farmer's crops, insects which damage them, are shown, as well as drawings hastily made with cheap materials, but which may be fastened to the walls of the car or held up while lectures are delivered to the rural audiences on subjects which will make their work more successful and pleasant. But more interesting to us in the present connection is the cheapness of the cases which the curator of the above museum has had built as a beginning towards those which he intends to have throughout the museum for the housing of instructive and useful exhibits, his idea being that while these cases are not all he would like to have them, still they will serve the purpose so that the public, old and young, scientist and layman, may derive benefit from the museum until such time as he has secured funds for ideal cases, and has decided what an ideal case is and what color to paint it. But now, he has found that if the school children of to-day derive benefit from the exhibits in these cheap cases, when they are women and men of to-morrow, his museum, though he may then be dead, will not want for ideal cases, an ideal fire-proof building, its own railroad train, or even the most valuable though perhaps not very instructive specimens.

With this inspiration, and having in the Rocky Mountains Museum a need to build at least one case as a sample and install it within three weeks, I designed a cheap case for a small museum or a museum having small funds. A contractor in Ottawa will make such a case for $10.00 or less, casing a museum for less than one-fiftieth the cost of our finest cases. Any ordinary house carpenter can make such a case. The materials may be obtained wherever window sashes are to be had. All the woodwork may be cut to sizes at the local mill, and this is especially desirable where a large number of cases are to be made, as it will save much of the expense of the carpenter work.

The kind of wood and moulding may be varied according to what is cheapest and most easily obtainable where the cases are being made, care being taken, however, if any moulding is used, to choose that which is simple, dignified, and will not gather dust. It may be desirable to let the size of the glass panels and even of the case depend somewhat on the size of glass that can be obtained.

The advocating of a cheap case, its manufacture, installation and use, in no way militates against advocating the best and most expensive cases on the market, their manufacture, installation and use, but on the contrary paves the way for them. The museum that waits to be useful until it can have cases costing many hundreds of dollars each will probably wait a long time for financial support. The museum that teaches and otherwise becomes useful to the public with clean, neat, though cheap cases, will gain the sound financial support which it deserves, at least as soon as the children of the present generation grow to positions of authority, and then the cheap cases may be discarded, or, better still, sold or given to a branch museum or a small struggling museum, and replaced by the very best cases to be obtained on the market or to be manufactured.

(To be continued).

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ON THE VALIDITY OF THE GENUS *PLETHOPELTIS*, (Raymond).

By Richard M. Field.

While studying some fossils collected by Dr. Percy E. Raymond from the Hoyt Quarry, Saratoga, the writer became interested in the relationship of the two forms which have been described by Walcott as *Agraulos saratogensis*. In his recent description (7) of the Hoyt fauna Dr. Walcott has figured a form with strongly outlined glabella, bearing glabellar furrows, while in his first description of the fauna he illustrated under this name a specimen with smooth glabella and very faint circum-glabellar furrow. This latter, or "smooth-glabella" variety, is found to predominate in the collection. A still closer inspection of the material seemed to show that although both forms may belong to the same species, it is extremely doubtful if they are to be placed under the genus *Agraulos*. The writer believes that the following evidence shows that Raymond was justified in erecting his new genus *Plethopeltis* for trilobites such as *Agraulos saratogensis* Walcott.

To determine the validity of the genus *Plethopeltis* it is necessary to discuss the following facts. Raymond, in the "Revision of the Bathyuridæ" (8) designated *Agraulos saratogensis* instead of *Bathyurus armatus* Billings, as the type of the new genus *Plethopeltis*. It is undertsood that he did this because only a single cranidium of *P. armatus* was known and no pygidium, while numbers of pygidia were found associated with *P. saratogensis*. Some doubt has recently been expressed as to whether after all the species *saratogensis* should be removed from the genus *Agraulos*. If the latter be the case, then the genus *Plethopeltis* automatically drops out of the nomenclature. Raymond's generic diagnosis of *Plethopeltis* is as follows:—

"Cephalon strongly convex, wider than long, without concave border or marginal rim. Glabella faintly defined, without glabellar furrows. Eyes small, situated well forward. Free cheeks rather wide, smooth, with short spines at the genal angles. Pygidium small, with few traces of segmentation; convex; no border."

The writer finds from the investigation of the material lately collected by Dr. Raymond that the characteristics given by him as "glabella faintly defined, without glabellar furrows" is neither a generic nor a specific characteristic. The present collection fortunately allows a close comparison of the variety first figured and described by Walcott (5), his holotype, and the plesiotype later figured by him in his description of the Hoyt fauna. Here we have the two varieties closely associated, having lived and died under the same physical conditions. Judging from the few well preserved specimens examined by the writer, not more than nineteen in all, it would seem that the form with the smooth glabella predominated. Further and more careful collecting is necessary, however, before this assertion can be proved. It should be noted that Walcott in his first description already noted (p. 276) noticed "two pairs of slightly indented glabellar furrows that curve inward with a slight backward obliquity; on the casts of the interior of the larger specimens the furrows are scarcely to be seen——." But he shows no trace of these furrows in his figure. At any rate the presence or absence of glabellar furrows has in this case at least, nothing to do with the generic classification. We shall have more to say regarding the development of glabellar furrows later.

Walcott (7) in his second paper gives the following description of *Agraulos saratogensis:*

"Head convex, slightly semi-elliptical in outline and terminating in round, short, postero-lateral spines; glabella moderately convex, truncate conical, sides converging slightly towards the broadly rounded front, about 1/6 longer than wide; marked by two pairs of slightly indented glabellar furrows that extend inward with a slight backward obliquity; on the casts of the interior of the larger specimens the furrows are scarcely to be seen; occipital furrow well defined and arched forward at the centre; occipital segment rising to a short blunt spine at the centre and narrowing toward the sides; dorsal furrow well defined about the glabella. Fixed cheeks narrow; anteriorly they merge into the broad, rounded, frontal limb and posteriorly into the short posterior lateral limbs; palpebral lobes small and situated a little in front of the tranverse centre of the head. The frontal limb about 1/4 the length of the head and curved down to the margin without an intervening furrow. Free cheeks convex and somewhat tumid, irregularly triangular in outline and without a marginal border. The associated pygidium is convex, strongly lobed and without a distinct marginal furrow. Axial lobe intermarginal, convex and divided into four annulations and an interior doublure by four distinct transverse furrows; lateral lobes crossed by three main furrows and two shorter ones, corresponding to the furrow on the lateral lobe of the thoracic segments, thus outlining the anchylosed segments in the pygidium; a fourth segment and the terminal portion are also outlined by a faint ridge. Thorax unknown. This is a very distinctly marked species allied to *Bathyurus armatus* Billings." (4).

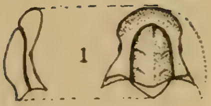
Corda (1) was the author of the genus and the first to figure *Agraulos* (in 1847) but his drawing is so inaccurate that one can hardly recognize any similarity between it and the original type described by him as *A. delphinocephalus*. Later, Barrande (2) gave an excellent description of the same species under the name *Arionellus ceticephalus*, declining to use Corda's generic name. Barrande's figures are so accurate that the indices worked out from these compare favorably, indeed very closely, with those worked out on the actual specimens. Barrande does not appear to have noticed the presence of eye-lines, a primitive aspect of this species and of many other Cambrian trilobites. One has but to compare the indices (38-64) to appreciate how widely Corda's figure differs from those of Barrande. A drawing from an actual specimen found in the type locality of Skrey, Bohemia, is shown on the plate, Fig. 3. The first mention of *A. saratogensis* was by Walcott (3) in 1879 when he listed it as *Ptychoparia* (*A.*) *saratogensis*. In his next paper (5) he referred the species definitely to the genus *Agraulos*. A copy of his figure is shown on the accompanying plate in Fig. 2. Walcott, (7) in 1912, figures another specimen of the same species showing a strong circumglabellar furrow; glabellar furrows and ridge, as shown in Fig. 1. Both of the varieties above described occur at the same horizon at the Hoyt Quarry. Raymond, (8) in his "Revision of the Species which have been referred to the genus Bathyurus," took *Agraulos saratogensis* as his type of the new genus *Plethopeltis*, as has been previously stated.

The writer made a critical and comparative examination of the features of the four types referred to above and has recorded a summary of his observations in the accompanying plate, which is to a large extent self-explanatory. Figures 1 and 2, representing the two variations of *P.* (*A.*) *saratogensis* are drawn from specimens from the Hoyt Quarry. Figure 3 is drawn from a specimen of *Agraulos ceticephalus* Barrande. Figure 4 represents *Plethopeltis armatus* (Billings). On the right of the figures are arranged in order the chief characteristics of the cephalons. On the left are placed the generic characteristics which connect *P. saratogensis* and *P. armatus*. In working out of the indices, the length of the cephalon was measured from the middle of the neck furrow to the anterior extremity, the length of the glabella being measured from the middle of the neck furrow to the anterior edge. The index in each case was derived by dividing the smaller by the larger measurement and multiplying the resultant by 1,000 to make it a whole number. It was hoped that by making careful measurements (within 0.25 of a mm.) that the indices would afford valuable criteria for the classification, but unfortunately the results do not appear to be decisive, probably because of the lack of sufficient working material. Nineteen specimens representing the total available material of *P. saratogensis*, were measured and their indices calculated. The average index proved to be 70 but a careful inspection of the individual indices showed this figure to be too low. Fourteen of the indices range between 75 and 80; only two fall below 70, while two others are as high as 85. The figures seem to show that further collecting would raise the average considerably. It is also important to note that measurements taken on *P. saratogensis* figured by Weller (6) as representative specimens from New Jersey show an index of 80. The writer has therefore made a conservative estimate of 75 as the index for *P. saratogensis*. So far as can be determined at present the index does not vary between the forms with smooth and those with furrowed glabella. Eleven specimens of *A. ceticephalus* were measured and their average index proves to be 63. This average was shown to be practically identical with that calculated from measurements made on Barrande's figures. The writer was forced to calculate the index for *P. armatus* from the original drawing by Billings. So far only one cranidium of this species is known, and its high index (88) may not be entirely indicative of the average for the species. All the evidence seems to show that the indices of *P. armatus* and *P. saratogensis* are very similar and dissimilar from that of *A. ceticephalus*. In addition, *P. saratogensis* and *P. armatus* have the following characteristics in common, which in turn are dissimilar from those of A. *ceticephalus:*

1. Greater convexity of the cephalon.
2. Eyes close to the glabella.
3. Cephalon never upturned at the anterior margin.
4. Facial sutures carried well forward.
5. Opposite portions of the circum-glabellar furrow nearly parallel and converging only slightly forward.

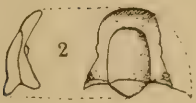
The writer therefore believes in the validity of Raymond's new genus.

Plethopeltis saratogensis



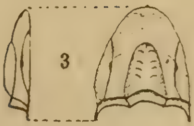
Index; 75.
Convexity; great.
Eyes; close to glabella.
Cephalon; unvariable, wider than long, never upturned at anterior margin. Posterior development into nucal spine.
Glabella; circum-glabellar furrow faint to strong, 2 pairs of faint glabellar furrows and median ridge.

Plethopeltis saratogensis



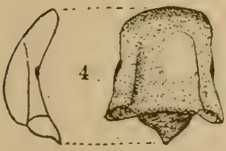
Index; 75.
Convexity; great.
Eyes; close to glabella.
Cephalon; unvariable, wider than long, never upturned at anterior margin. Posterior development into nucal spine.
Glabella; circum-glabellar furrow faint to strong, no glabellar furrows, no ridge.

Agraulos ceticephalus



Index; 63.
Convexity; low.
Eyes; farther apart than in preceding.
Cephalon; variable, from wider than long to longer than wide, anterior margin slightly upturned in some specimens. No nucal spine.
Glabella; no circum-glabellar furrow, 4 pairs of glabellar furrows, ridge, eye lines.

Plethopeltis armatus



Index; 88?
Convexity; great.
Eyes; close to glabella.
Cephalon; only one known. No signs of upturning of anterior margin. Nucal spine better developed than in 1 and 2.
Glabella; circum-glabellar furrow faint and dying out anteriorly. No glabellar furrows. No ridge.

Characteristics common to 1, 2 *and* 4.

1. Great convexity.
2. Eyes close to glabella.
3. Cephalon never upturned at anterior margin.
4. Facial sutures more nearly similar.
5. Circum-glabellar furrows similar in outline and roughly parallel.

Development and Distribution.

The writer does not propose here to discuss the genus *Plethopeltis* but there are one or two points which are of interest regarding the morphological development and migration of the species, *P. saratogensis*. By glancing at the diagrams it will be seen that both 1 and 2 are referred to the same species, although certain morphological features are shown to be more strongly developed in one than in the other. As has been mentioned previously, the "smooth-glabella" forms predominate in the present collection and it is reasonable to suppose that this form is also the more stable, exhibiting more specialized development. Why the type possessing glabellar furrows and ridge should have persisted may be attributed to some inhibitor which is difficult to explain at present. At first the writer was led to believe that the differences of glabellar furrows and circum-glabellar furrow was one mainly of preservation, but a more careful inspection of the material has led to the conclusion that this is not the case and that we have in the specimens collected from the Hoyt Quarries two distinct types, showing stages of gradation from the smooth to the furrowed form. In the development of the species the glabellar furrows and ridges are the first to disappear while the circum-glabellar furrow often persists into the more specialized individual.

Cushing and Rudemann (9) describe the rocks in which the species occur as follows:

"———— the Hoyt is a local phase of the upper Theresa, *probably an off-shore phase*———. The waters were clearer, less subject to incursions of sand, *Crytozoon* reefs flourished as they did not in the normal Theresa, and trilobites and gastropods lived on the surface of the reefs, where we find their fossil remains to-day."

When we consider the specimens of *A. saratogensis* described by Weller (6) from New Jersey we notice here that only the "smooth glabella" forms are represented. Weller stated that: "———— glabellar furrows————are wholly absent from the New Jersey specimens." The pygidia associated with the New Jersey specimens do not entirely agree with the description of that portion of the animal as it occurs at Saratoga, the transverse furrows being much less conspicuous. Notwithstanding these differences the specific indentity of the specimens from these two localities can hardly be questioned. Most of the specimens observed are smaller than the one illustrated, some of them being less than 5 m/m. in length. The writer also found a large number of small individuals amongst the specimens from the Hoyt Quarry, but these were not measured for obvious reasons. It would seem as if Saratoga were the centre of distribution for this species and that only the fixed type was able to migrate.

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DEPARTMENT OF GEOLOGY,
HARVARD UNIVERSITY.

CORRESPONDENCE.

THE EDITOR, THE OTTAWA NATURALIST.

Mr. P. A. Taverner's "Suggestions for Ornithological Work in Canada," strike the right note. At present we Canadian bird lovers are more in touch with Washington, D.C., than with our own Ottawa. Only a few of us even know each other. By the formation of an Audubon Society in Winnipeg recently an attempt has been made to bring bird observers together. Hardly anyone in the West outside a limited circle is aware of the splendid original work of Norman Criddle and his brother Stuart. Probably none of your readers have the least idea that in A. G. Lawrence, of Winnipeg, and H. E. Pittman, of Wauchope, Sask., there are some rising lights in nature lore, especially in ornithology. I could name a few others, old and young, who might be linked together for the purposes suggested by Mr. Taverner. As a writer of sorts and as a lecturer on our birds I am impressed by the unused material lurking in Manitoba alone.

H. M. SPEECHLY, PILOT MOUND, MAN.

A CHEAP CASE FOR SMALL MUSEUMS.

By HARLAN I. SMITH.

Geological Survey, Ottawa.

(Continued from page 36).

One form and size of this case is practically a simple box, three feet wide over all with a window sash screwed on as a cover. The sides of the case may be 7 feet high. The top and bottom of 1⅛ inch material, 1 foot wide, is set in about 2⅛ inches, more or less, from the ends of the sides. These four boards constitute the box frame without front or back. A piece 2½ inches wide and as thick as the window sash, usually 1⅜, or, better, 1¾ is nailed across from side to side at the top and bottom of both front and back to strengthen the frame and to cover the space above and below the top and bottom of the case; the lower one also serves as a support upon which the lower edge of the glass front and glass or wooden back frames may rest. This 2½-inch strip only partly covers the edge of the top and bottom, so that the screws holding the front and back may be inserted into the top and bottom, but also so that there may be no crack or space from the front or back into the space left at the outside of the top and bottom of the case. A kicking moulding may then be put across from side to side at the bottom of the case, both front and back, but it should not project beyond the sides of the case, as this would prevent several cases being placed close together, side by side. In short, the sides of the case should be flush. A board is next put over the top of the case to keep dust, etc., from gathering in the space outside of the case top, and to give the case finish. This board should project an inch or two in front and behind, but as in the case of the kickboard should not extend beyond the sides of the case except where a case is to stand alone. A moulding may be placed below this top in the corner between it and the 2½-inch strip across the top of the front of the case according to taste. The general label of the entire case may then be fastened on this moulding on the 2½ inch strip or from the cover of the case to the 2½ inch strip, by means of round headed screws through the middle of the end of the label board. In fact one purpose for having the case extend above the top of the exhibition space, that is above the top of the glass sash, is to provide this space for a case label. On the other hand a case label may be painted directly on the 2½ inch strip, or the sash.

The front of the case is made of a simple window sash, such as may be obtained in any town where a sash and door factory exists, or for that matter any place where houses are built. It is fastened with round headed screws engaging the edge of the sides and top of the case, the frame resting upon the 2½ inch strip across the lower part of the case. By screwing the frame on, it is not necessary to go to the expense of hinges and locks. The screw holes may be soaped, waxed, or metal screw sockets may be used if it seems desirable to go to that expense. A screwdriver serves as a key. Moreover, by drawing the screws tight, the case may be made as near dust-proof as is necessary in a small museum. In fact much more fuss is made about dust-proof cases and about getting fine cases than about using them, after fine dust-proof cases are obtained; that is, the curator's energy seems to be used up in getting building, cases, and specimens; then he rests on his oars as a rule, leaving the exhibits without understandable labels, and practically useless. A little attention given to wiping out cases, cleaning specimens and looking to the upkeep of the specimens in most cases would be cheaper and quicker than giving so much attention to dust and insect proof cases. Moreover, going over the specimens say once a year for such a purpose, the curator could hardly fail to note the lack of order and labels, and many things which he would then want to do to improve the usefulness of his exhibit. However, cotton tape or wicking set in a planed groove may be added to exclude dust if desired.

The frame should be cut down on the outer sides and ends as much as is consistent with sufficient strength to hold the glass, but of course it cannot be cut down to less than the ⅞ of an inch necessary to cover the edges of the sides and top of the exhibition case, to which it is screwed. The glass should be in the largest pieces obtainable, up to the full size of the frame, and where more than one piece of glass is required preference should be given to running the mullions horizontally so that they may the more often fall opposite a horizontal shelf edge instead of vertically across the line of vision. It is hardly necessary to say that the glass should be of the best quality which the museum can afford, and certainly should be free from blebs and other blemishes. If it is sufficiently heavy, there will be no need of disfiguring signs requesting visitors not to lean on the glass.

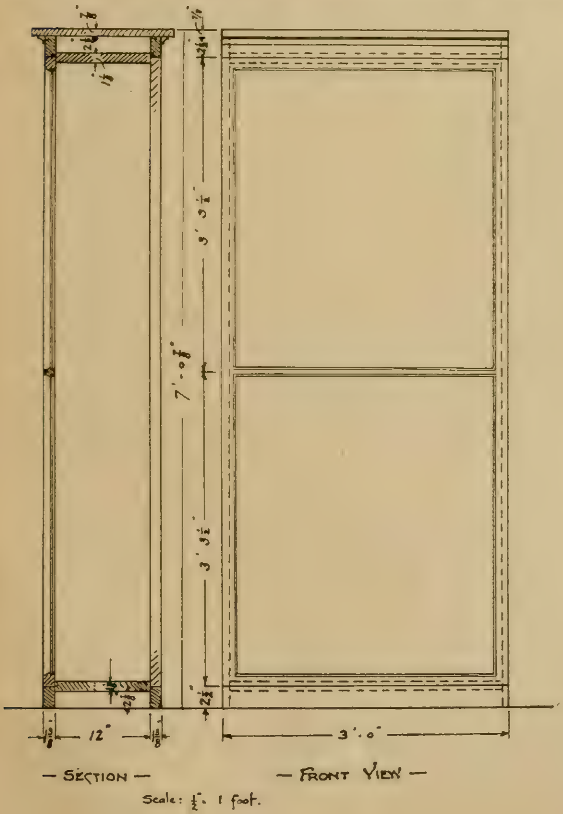
Shelves may be cut about ⅛ of an inch shorter than the top and bottom of the case, so that they may be moved easily and may rest upon round headed screws, or, still better, on screw eyes turned horizontally in the sides of the case, one at each corner of the shelf. When it is necessary to raise or lower the shelf these screws are easily changed and the holes may be puttied up and touched with color, although if left they will no more disfigure the case than the ordinary ratchets used for holding shelves at various heights. The case may be stained or painted with a dull finish, certainly not a very glossy varnish, perhaps preferably with a thin wash, to give it a somewhat neutral color in harmony with that of the walls of the building in which it is to stand.

The back of the case, it seems, should certainly be put on in the same way as the front, so that if it is ever desirable to turn the case at right angles and have glass upon both front and back, the back may be removed and a glass frame similar to the one in front may be put on as easily as one would open and shut the case to put in or take out a specimen. If the back is to be solid woodwork, which is perhaps desirable where heavy things are to be hung from it, care should be taken that it is built so that the expansion and contraction due to changes in the weather or the heating of the building may not strain the rest of the case, and the boards should run up and down or crosswise rather than either diagonally or possibly even in panels, so that they may not be optically disagreeable in connection with the exhibit. Perhaps as good a way as any would be to let the back of the case be a frame with compo board instead of glass, as the compo board could be replaced at any time glass was desired, and meanwhile would serve very well as a background to exhibits or upon which to hang exhibits that were not too heavy. A diaphragm set back against the rear frame would serve for heavy objects and be desirably smooth or could be covered with burlap, paint, paper, or what not, as desired.

When the case has glass front and back, that is, when the exhibit is to be viewed from two sides, or when it is not desirable to use the full depth of the case for the exhibit on hand, a diaphragm about ⅛ of an inch shorter and narrower than the inside of the case may be inserted at any distance from the front of the case, and held in place either with round headed screws through the sides of the case or with small angle irons or ⅞-inch cove, in front and behind the diaphragm at the corners, or oftener according to taste and the amount of strength desired. This method of fastening the diaphragm allows it to be adjusted or removed in a very few minutes with practically no waste and no unsightly scars which could not be retouched with putty and colored, or which if not retouched would be no more unsightly than the complicated and expensive diaphragm holders usually used.

The cases should be made in uniform sizes or multiple sizes like sectional book cases, so that they may be moved about and reassembled, for instance, by placing two 3-foot cases side by side to harmonize with a 6-foot case, and so on, or by placing two cases 6 inches deep back to back, to approximately harmonize with a case 1 foot deep. Cases should never be fastened to the walls of the room in such a way that when they are moved the room is disfigured, requiring replastering, repainting of the replastered part, and then, as so often happens, repainting of the entire room because it is discovered that the patch of new painting does not match the whole because of its freshness. A little forethought along these lines will save a large portion of the funds of museums which might be used for other purposes, instead of being thrown on the junk heap.

If it is desirable to let light in one or both sides of the case they may be made like the front and back, but then care must be taken that the frame is large enough to hold the screws necessary for supporting any shelves used. If a diaphragm is used, the screws to hold the rear corners of the shelves may be inserted in the diaphragm.



These general plans may be varied, the cases may be made of various heights, various widths, and various depths. They may be built with higher or lower bases and tops; or again shorter cases may be built and placed upon tables or pedestals; cases may be super-imposed or hung upon a wall. Very large cases might be made on this same principle, by substituting frames with glass in place of the wooden sides of the cases, it being only necessary in such cases to carry the sides up and down from the top and bottom of the frame in the same manner that the front and back is carried up and down. If the case is so large, as for habitat groups, that it is necessary to have more than one frame, a mullion to which to screw the frames may be inserted between the top and bottom of the case where necessary, but this should not project sidewise beyond the wooden frame. By this means the amount of wood exposed to view is kept at a minimum, whereas in many cases such as we often see, the mullion is exposed to view and the frames are on each side of it, making three thicknesses of wood to obscure the exhibit instead of only two. If desired, a moulding can be screwed over the crack where the frames meet, and if fastened to one of the frames that frame may be taken off first in opening and closing the case, which will save the trouble of unscrewing the moulding.

In the simple cases the front and back sashes may all be made the same size; where the cases are not very deep and sashes are used in the sides, it will of course be necessary to have a smaller size of sash for the sides; but if the cases are very large this will not be necessary, although it will make any attempt at a square case as much longer than it is wide as twice the thickness of the sash, unless the frame at each corner laps the same direction.

One of the simple forms of these cases three feet wide by one foot by seven feet, was made, with the exception of the frame and glass, by two carpenters, during the time which they could take from other work in a single day while assisting in reorganizing the Rocky Mountains Park Museum. It was thought that the frame and glass could be put on later The case was wanted immediately and an exhibit was installed in it as soon as it had been given a coat of stain. This seemed a fair test of the cheapness, ease and speed with which such cases could be made available.

The specifications which have been made by Mr. P. A. Taverner to accompany this description are for a somewhat more complicated and slightly more expensive case, and consequently a number of the dimensions and methods of construction are slightly different.

SPECIFICATIONS.—BY P. A. TAVERNER.

MATERIAL—LUMBER.

All material in case to be of clear, white pine, whitewood or other material most readily obtainable in locality, in clear lengths free from large or unsound knots or shakes.

All exposed work may be in oak or other wood to match fittings already installed.

SASH.

To be 1⅜ inch thick of common stock pattern—rails and styles 2 inch wide from glass to jamb, and of sizes as shown.

TOP AND SIDES.

May be of ⅞ stuff with ⅜ inch by 1⅜ rebate along sash jamb or may be built up of two thicknesses of ½ inch stuff. The inner lining being of matched stuff well cramped together and blind nailed.

DIAPHRAGM TO BE SUPPLIED ONLY WHERE DESIRED.

To be of ⅞ inch stuff fastened together with flush end styles well nailed to prevent warping. All should be covered, both sides with burlap or other covering material, or paneled according to decoration or other scheme of museum. Diaphragm to be held upright and in place by 1 inch by 1 inch by ⅛ inch iron angles screwed to top and bottom of case on either side of diaphragm. For three-foot cases there should be two pairs of such angles, top and bottom, and for six-foot cases there should be three such pairs. Diaphragms may be moved to any situation in case by changing position of angles.

SHELVES.

Shelves for light specimens may be supported by screw eyes inserted in ends and diaphragm or mullions as indicated on drawings, turning them flatways and allowing them to project enough to engage shelves. For heavy specimens, iron brackets—stock sizes, or Shrosbree specimen hangers may be used whenever needed. If a coarse burlap is used over diaphragm, screws may be put in and removed as many times as necessary without causing disfiguring scars on the surface.

BASE OR MOPBOARD.

To be stock 6 inch base of whatever design may be desired and may be readily obtained at local lumber yard or mill.

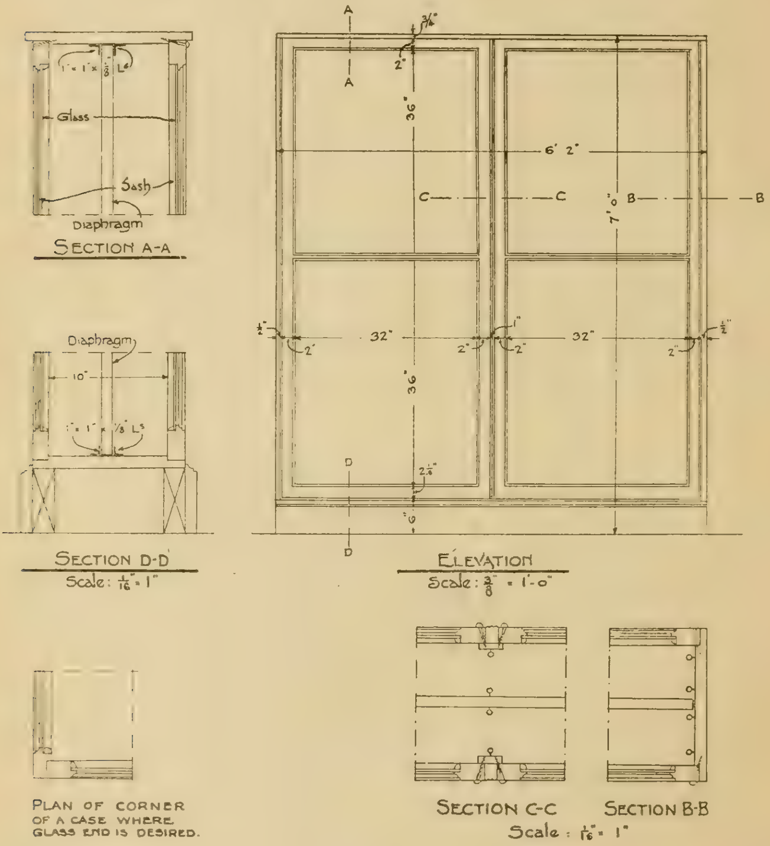
SIDES.

All sides of cases to present perfectly flush surface, so that two or more cases may be butted together to appear as one case without unsightly or dust catching spaces between.

Cases may be made in units of either 1 or 2 sash. A 1 sash case will then be just half the length of the 2 sash cases and will line up with them in series. The sashes are to be fastened in place by 2½ inch brass, round headed screws, driven through the sash into the frame behind. With this method neither locks or hinges are necessary, and all can be constructed by an ordinary carpenter without special joinery skill.

GLASS.

To be the sizes shown and of as good quality as procurable under the circumstances. The principal faults to be looked for being color, waves, bubbles or flaws.


1" × 1" × 1/8" L⁸
Glass
Sash
Diaphragm
SECTION A-A
Diaphragm
10"
1" × 1" × 1/8" L⁸
SECTION D-D
Scale: 1/16" = 1"
A
3/4"
2"
36"
6' 2"
C
B
7' 0"
1/2"
32"
2"
1"
36"
D
2 1/2"
9"
ELEVATION
Scale: 3/8" = 1'-0"
PLAN OF CORNER OF A CASE WHERE GLASS END IS DESIRED.
SECTION C-C
SECTION B-B
Scale: 1/16" = 1"

A CHEAP CASE FOR MUSEUMS
DESIGNED BY HARLAN I. SMITH
WITH
PLAN AND SPECIFICATION BY P. A. TAVERNER
GEOLOGICAL SURVEY, CANADA

CONCHOLOGICAL NOTES.

But few mussels have been recorded from the Hudson Bay drainage area of Ontario, though many must occur.

Mr. J. B. Tyrrell, who explored the District of Patricia in 1913, found *Unio* (*Lampsilis*) *luteolus* in the Fawn and Severn about lat. 54° N. The species doubtless extends down to Hudson Bay as it does down the Mackenzie. The shells are smaller and lighter in color than these of the same species from the Rideau river and the Rideau canal. In the latter between Bank and Concession Streets, Ottawa, they are ordinarily of large size, green in color, and beautifully rayed. The Patricia shells resemble closely the *L. luteola* found in Lake Nipissing at North Bay, and in Lake Talon, near Rutherglen, but are not as yellow on the same species from Lake Gauvreau in the Gatineau hills.

No mussel peculiar to America has a wider range than this. It is found from the Brazos of Texas to the Arctic Circle and from the Rocky Mountains to the St. Lawrence and the Hudson drainage areas. Throughout this vast extent, under conditions varying from crystal lakes and streams to muddy sloughs and pools, in polar cold and torrid heat, it preserves unvaried the peculiar undulations of the beaks which distinguish it from allied species. It thus affords a striking proof of the proposition of Quatrefages, that specific characteristics—properly so-called—are not permanently affected by environment.

An *Anodonta* found by Mr. Tyrrell in the Fawn river has the beaks so eroded that it cannot be identified. It is not improbably *A. kennicottii* Lea, which was described from Lake Winnipeg and Great Slave lake.

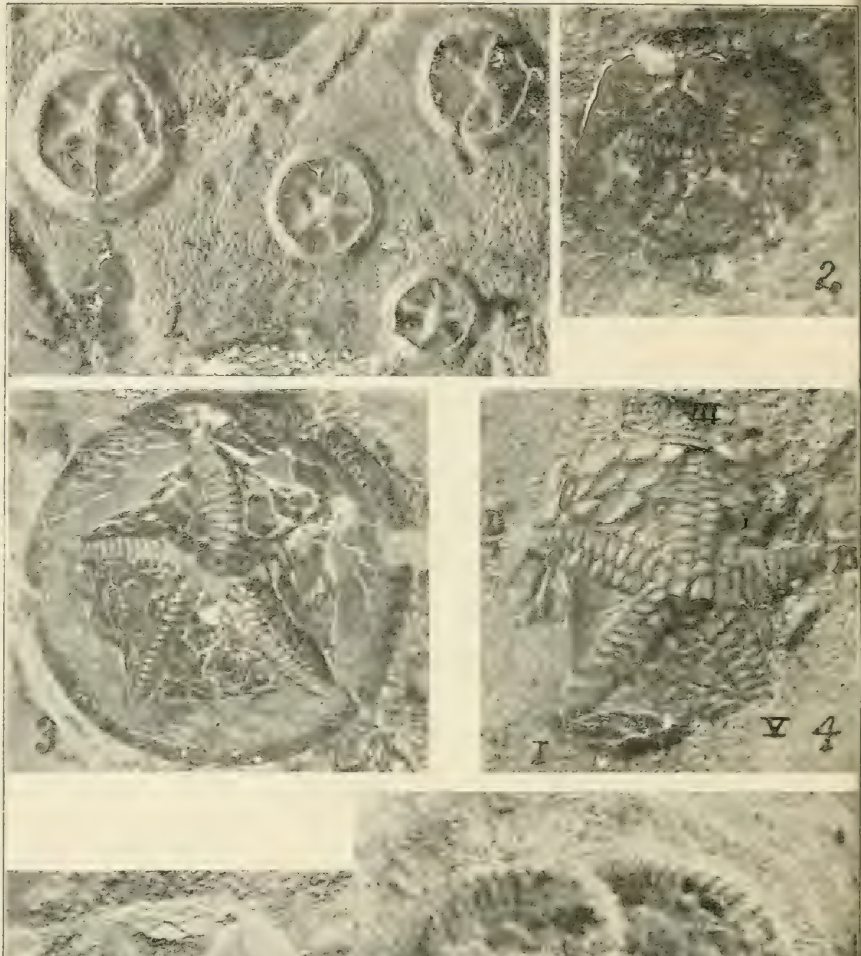
Another lot of mussels from Northern Ontario was collected in 1914 by Mr. J. K. Latchford in the Missinaibi, where on its way to Hudson Bay it flows under the National Transcontinental Railway, about twenty miles east of Hearst. They are mainly *L. luteola*, but include two Anodontæ which may be undescribed. Throughout Ontario, especially northward, the Anodontæ, or paper-shell mussels, abound. It is seldom, however, that any but mature specimens are collected. The beaks of old shells are nearly so always eroded that positive identification is extremely difficult, except in the case of a few species with prominent characteristics. The result outside of narrow limits is absolute confusion. It is safe to say the only thin-shelled mussels found near Ottawa which can be identified with any certainty are *A.* (*Strophitus*) *edentula* Say *A. cataracta* Say (= *fluviatilis* Dillw. of our lists) and *A. subcylindracea* Lea. Many others undoubtedly occur. In the Rideau canal for instance, while it is impossible to distinguish two species among the large Anodontæ found there, a series of young shells, such as may easily be obtained in the little bay on the left side of the canal immediately above Hartwell's Locks, demonstrates the presence of two species—one certainly *cataracta* Say, and the other probably *implicata* Say. I used the word "probably" because I do not know what the young of *implicata* are like, and I know of no satisfactory description. Stimpson in his Descriptive Catalogue of the Naiades (Detroit, 1914) says "their sculpture consists of straight bars running parallel with the linge line, or they may be slightly curved and sometimes a little corrugated,"—which seems to me a confounding of two species. The beak sculpture of the Unionidæ is—I have observed—for any species invariable. *A. cataracta* in every stage of growth has been collected by the writer in at least fifty localities in Quebec and Ontario—from the lakes in the Laurentides to Toronto Bay, where it occurs with *A. grandis* Say—and the undulations of the beaks, when they could be made out, were in every case the same.

In addition to the three species named, many others occur in the Ottawa valley, but, until large series of shells are procured in every stage of growth, they cannot be determined, or, if new, described. It is really not more difficult to collect the young of mussels than to collect other small bivalves; that they cannot be seen should not prevent a search for them—nor the fact that they are often far less numerous than adults. A wire bowl strainer with a suitable handle will often produce the most astonishing returns from places that appear quite barren of molluscan life.

Till the Missinaibi is visited by an experienced collector, the Anodontæ from it can be regarded as only *probably* new.

Among the Missinaibi shells are two medium sized examples of *Unio pressus* Lea, now designated *Symphonota compressa* Lea. In addition of the localities mentioned in previous notes—the Rideau at Strathcona Park and Paquette's Rapids, near Pembroke and Moore's Creek on the Aylmer Road, and a brook crossing the Opeongo Road, near Foymount, in the County of Renfrew, afford this attractive little mussel. It has been recorded from as far north as the Montreal river near Sault Ste. Marie (Stimpson, Des. Cat. 483) but has not hitherto been known to exist in the Hudson Bay drainage.

L.


1
2
3
III
II
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V
4
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Illustrating Dr. Raymond's paper "Revision of the Canadian Species of 'Agelacrinites.'"

THE OTTAWA NATURALIST

VOL. XXIX. AUGUST-SEPTEMBER, 1915 Nos. 5 and 6

REVISION OF THE CANADIAN SPECIES OF "AGELACRINITES."

By Percy E. Raymond*

There are two famous regions for these pretty medallion-like little fossils, one in the Trenton formations of Ontario, and the second in the younger Cincinnatian and Richmond strata of southern Ohio and Indiana. The localities in Ontario have produced by far the more perfect specimens, but those found in the higher strata of the "Cincinnati dome" are generally larger. The specimens found in the latter region are almost always attached to a shell of some sort, most often a brachiopod, generally a *Rafinesquina*. In Ontario it is very unusual to find a specimen attached to any foreign object, though such specimens do occur.

It has been the custom to refer all the Canadian specimens to two species, *Agelacrinites billingsi* Chapman and *A. dicksoni* Billings, while a third name, *Agelacrinites chapmani*, has been current, and ascribed to Billings, though I cannot find that such a species was ever described. In the present paper several new species are described. More adequate illustrations will be given in a paper soon to be published in the Bulletin of the Victoria Memorial Museum.

Genus Lebetodiscus Bather.

Lebetodiscus, Bather, Geol. Mag. dec. 5, 5, 1908, p. 550. Type, *Agelacrinites dicksoni* Billings.

Dr. Foerste in his recent "Notes on Agelacrinidae"† remarks that a new name is required for the Ordovician species usually referred to *Agelacrinites* or *Lepidodiscus*. It seems, however, that a name proposed by Dr. Bather in the third of his Studies in Edrioasteroidea, entitled "Lebetodiscus, N.G. for Agelacrinites Dicksoni, Billings," may possibly supply the want.

Bather proposed the name after studying the incomplete specimen of *Agelacrinites dicksoni* collected by Bigsby and figured by Billings as figs. 4 and 4a of plate 8 of the third of the "Decades."

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†Bull, Denison Univ. 17, p. 400, 1914.

Specimens of this species are rare and the best one known is that figured by Dr. (now Sir James) Grant in the OTTAWA FIELD NATURALIST. During my incumbency as Invertebrate Paleontologist to the Geological Survey, this specimen was donated, among other valuable fossils, to the Victoria Memorial Museum, and after comparing it with Billings' and Bather's figures, I am convinced that it is a real *Agelacrinites dicksoni*. Bather states that *Lebetodiscus* differs from *Agelacrinites*, first, in the absence of a differentiated marginal zone; this I believe is due to the imperfection of the specimen he studied; second, he regarded it as having a less flattened and less sessile habit; this also proceeds from the study of an incomplete specimen; third, "It seems clear that the side plates, here called flooring plates, are homologous with the flooring plates of *Edrioaster*. Whether those plates have homologues in the Agelacrinidae is a matter for debate; at any rate, no genus of that family has similar plates with intervening depressions so like pores." I may have misunderstood the figures and descriptions of both writers, but as I understand it, the "flooring plates" of Bather in *Lebetodiscus* are the same as the "outer covering plates" of Foerste, and Bather's specimen was not so preserved as to enable him to get at the real flooring plates, which in a Canadian specimen, are concave and single, not double. (Compare Dr. Bather's fig. 1, p. 545, with Dr. Foerste's figs. 1, pl. 1, fig. 4, pl. 2, and fig. 4, pl. 3, or, for the genus *Thesherodiscus*, fig. 8, pl. 1). The small plates which Dr. Bather took for the real covering plates are the "median or intercolated covering plates" of Foerste. I see no real difference between the structure of the subvective system of *Lebetodiscus* and such a typical (Ordovician) *Agelacrinites* as *A. pileus*, except in the large pores between the lateral covering plates. These may, however, be of such importance as to justify the restriction of *Lebetodiscus* to the species *L. dicksoni* and *L. loriformis*, and the creation of two new genera for the reception of the other species here described.

LEBETODISCUS DICKSONI BILLINGS.

Billings, Rept. Progress, Geol. Sur. Canada, 1857, p. 294; Can. Org. Rem., dec. 3, 1858, p. 84, pl. 8, figs. 3, 3a, 4, 4a; Chapman, Expos. Min. Geol. Canada, 1864, p. 110; Grant, Trans. Ottawa Field-Nat. Club, 1, No. 2, 1881, fig. 9; Jaekel, Stamm. Pelmat. 1899, p. 50, pl. 2, fig. 2; Clarke, Bull. N. Y. State Mus. 49, 1901, p. 191, fig. 3; fig'd without name by Sowerby, Zool. Journal, 1825, 2, p. 318, pl. 11, fig. 5.

Of this rare species, the Museum of the Geological Survey contains the type, another poor specimen collected by Billings (No. 1415), a specimen collected by Mr. Fitzpatrick at Peterboro, Ontario, (No. 1412), and the beautiful specimen donated by Sir James Grant, and figured by him in 1881.

The type is a very poorly preserved specimen, as is also the one numbered 1415. This specimen has been cut so as to expose a section across arms II and III, and the section of the anterior arm shows that the structure is the same as in *Agelacrinites pileus*, there being a single concave flooring plate, and two roofing plates meeting above the groove thus formed.

Sir James Grant's specimen of *Agelacrinites dicksoni* is the finest one of this species which has been found, and it seems undeniable that it belongs to the same species as the specimen described by Dr. Bather. It has the same large pores along the sides of the rays, and the same large inter-ambulacral plates. The super-oral series is well shown, and is of the same type as in *Agelacrinites pileus*, *billingsi*, and others. There is a single plate behind the center opposite the anal inter-radius, and two in front, between rays II and III, and III and IV. On each side of the lower plate there are two narrow side plates, and two more small plates outside the upper plates. The breaking up of these plates and the introduction of some of the proximal ray plates into the disk probably accounts for the large number of supra-oral plates seen in the specimen figured by Dr. Bather.

The inter-ambulacral areas are beautifully preserved in this specimen, showing between the arms the very large plates which are so characteristic of the species, the smaller but still large plates just outside the arms, and the very small plates of the outer border.

Finally, there is the Bigsby specimen on which Dr. Bather based the genus *Lebetodiscus*. It agrees with other specimens of *A. dicksoni* in having five contra-solar rays, subequally spaced, in having the outer covering plates but slightly inter-locking over the rays, in having very large inter-radial plates and in the size and position of the anal structure. It differs in lacking the outer border, but after an inspection of Dr. Bather's photograph, one is easily persuaded that that is due entirely to an accident of preservation, as half the known specimens of *A. dicksoni* lack the border entirely or in greater part. There appears to be a difference between the supra-oral region of the Bigsby specimen and that of the other specimens known. In that specimen the arms seem to be more or less massed together to form a sort of supra-oral disk, somewhat as in *L. inconditus*. It is not possible to make out the orientation of these plates without seeing the specimen, but as stated above, it seems possible that the appearance of a large disk is due to the disturbed condition of the plates.

Horizon and locality:—All the specimens of this species whose exact locality is known have been found in the Cystid beds of the Prasopora zone, and about 180 feet below the top of the Trenton. Beside Peterboro and Ottawa, a specimen has been listed by Dr. Ami from Pakenham, Ontario. The specimens from Kirkfield identified by Mr. Springer as this species are almost if not entirely all *L. multibrachiatus*.

LEBETODISCUS LORIFORMIS SP. NOV.

(Plate 1, fig. 6).

This specimen has long been known to the collectors about Ottawa as one of the prizes of Dr. Van Cortlandt's collection. (Now in the Museum of the Geological Survey, No. 1414). It has always been considered as an abnormal, long-rayed specimen of *Agelacrinites dicksoni*, and there can be no doubt that it is very closely related to that species, but since it forms one of the "connecting links" with the species of the later formations, I propose to give it a new name. It may be described briefly as a *Lebetodiscus* with rays so long that each one nearly touches its neighbor, all rays contra-solar, and equally spaced, the outer border of small plates narrow, supra-oral structure apparently as in *L. dicksoni*. This species is believed to be ancestral to the very long rayed forms for which Hall erected the genus *Streptaster*.

The holotype is 23 mm. in greatest diameter, and is from the Trenton at Ottawa, Ontario. Probably from the "Cystid beds," about 180 feet below the top of the formation. It is No. 1414 in the Victoria Memorial Museum.

LEBETODISCUS BILLINGSI (CHAPMAN).

Agelacrinus billingsi Chapman, Canadian Journal, 5, 1860, pp. 358, 204.

Hemicystites (*Agelacrinites*) *billingsi* Sladen, Quart. Jour. Geol. Soc. London, 35, 1879, p. 750.

Agelacrinites billingsi Chapman, Ann. Mag. Nat. Hist. third ser. 6, 1860, p. 157, fig. ; Billings, Canadian Journal, n. s. 6, 1861, p. 516, fig. 86; Chapman, ibid., n. s. 8, 1863, p. 199, fig. 180; Expos. Min. Geol. Canada, 1864, p. 110, fig. 86, p. 171, fig. 180.

Hemicystites billingsi Jaekel, Stammes. Pelmat. 1, 1899, p. 49.

Local collectors have for a long time recognized two forms of *Agelacrinites billingsi* in Ontario, one with straight, and one with curved rays.

Chapman's original specimen, collected at Peterboro, was of the straight-rayed variety. The species has never been properly described or figured, though fairly common. I am now restricting Chapman's name to the form with straight rays and the plate ornamentation described below.

DESCRIPTION.

Specimens small, circular in outline, not ordinarily resting upon any foreign object. Rays five in number, narrow, straight, and tapering but little toward the distal end, the two rays enclosing the anal inter-radius a little further apart than the others. Each ray has about thirteen pairs of alternately placed lateral covering plates, which are truncated at the ends, so that they interlock along the median line. The points of these plates are curved, so that when the ray is slightly sagged apart, alternating pores are seen between the covering plates. Over the central area, presumably covering the mouth, there are three principal plates, a large one next to the anal inter-radius and two smaller ones anterior to it.

For convenience in speaking of these fossils, the anal inter-radius is called posterior, the ray opposite to it anterior, and the rays numbered in clock-wise (solar) order, beginning with the one at the left of the anal inter-radius.

The single large plate of the supra-oral series is then, between rays I and V, and its great width is due to the enlargement of the posterior inter-radius by the anal opening. The other two plates are inter-radial in position, one being between rays II and III, and the other between III and IV. There are also two other narrow, five-sided plates accessory to the supra-oral system, one between rays I and II, and the other between IV and V. These plates at their proximal edges abut against the anterior supra-oral plates. Numbering these plates according to the inter-radial areas which they oppose, we have the broad posterior one as 5, the next one to the left 1, the first anterior lateral 2, second anterior lateral 3, and the right posterior lateral 4.

There can be no reasonable doubt that Chapman's specimen had this structure. In his principal description, in the Ann. Mag. Nat. Hist. he says: "These rays, at their origin, leave a small central space covered by larger and somewhat rhombic plates. The latter appear to be five in number, and to constitute the first ray plates, one being common to two adjacent rays."

None of the covering plates, either of the rays or of the supra-oral system, seem to be in any way joined together, but were probably all movable. The three principal supra-oral plates, Nos. 2, 3, and 5, are of such form and strength as to suggest that they could have functioned as jaws.

The inter-radial spaces are covered with small imbricating plates. The anal opening is surrounded by a small pyramid of six triangular plates.

Just outside the tips of the rays there is a ring of large, thick plates ornamented ith pits and rather large granules. There are two or three of these plates opposite each inter-radius except the posterior one, which has four. These plates are much thicker and less scale-like than is usual in this group of fossils, and such ornamentation of the plates is unique in the family.

Chapman says that his specimen was ½ inch in diameter. Specimen 1413 is 12 mm. in diameter, while another, 1408E, is only 10 mm.

The plate structure as here described seems to be common to several species of *Agelacrinites* and *Cytaster*.

Horizon and locality: This species, as now restricted, is fairly common, but only at the type-locality. The original specimen was found at Peterboro, Ontario. At this city, specimens of *Agelacrinites* have been found in some numbers in an old quarry near the entrance to Jackson Park, and it is presumed that the original specimen came from that locality. If so, it was from the "Cystid" beds of the "Prasopora zone."

LEBETODISCUS YOUNGI SP. NOV.

(Plate 1, fig. 4).

This species is very like *L. billingsi*, having straight rays, the same supra-oral structure, and about the same size. It differs in lacking the thick, ornamented plates of the outer ring and the rays are broader. The inter-ambulacral areas are covered with large transversely elongated, scale-like, imbricating plates, about fifteen to each of the lateral and anterior areas, while in the posterior inter-radius the plates are somewhat smaller and more numerous. The anal opening is surrounded by two circles of small plates, five or six of which are in the inner circle. Outside the area to which the rays extend is a narrow margin of smaller imbricating plates.

The holotype (No. 3234, Vict. Mem. Mus.) is from lot 12, Con. I, Eldon, Ontario, where it was collected from strata belonging to the upper part of the "Prasopora zone" of the Trenton by Mr. W. A. Johnston. The name is in honor of Dr. G. A. Young, of the Geological Survey.

LEBETODISCUS CHAPMANI SP. NOV.

(Plate 1, fig. 3).

This species may be described briefly by saying that it differs from *L. youngi* in having longer and more slender rays, all of which show a slight curvature in the contra-solar direction, and also in having a wider border of small plates. The plate arrangement is the same at in *L. youngi*, but the lateral covering plates are not so narrowly pointed on their inner ends. No median covering plates have been seen.

The specimen selected as the holotype is 18 mm. in diameter.

This is one of the forms which have been identified usually as *A. billingsi*, but as it persistently differs from it, as well as from *L. youngi*, in the points mentioned, and through them is intermediate in characteristics between *L. billingsi* and *L. pileus* of the Upper Ordovician, it seems to be worthy of a specific name.

Ray I of this species is almost straight, the only curvature being just at the point where it joins the peristomal plates. At the outer end there is no curvature.

Ray IV is the most curved of any on the type, and all show the greatest curvature at about half way between center and margin.

Horizon and locality:—The holotype (No. 3235, Vict. Mem. Mus.) is from an abandoned quarry near the entrance to Jackson Park, Peterboro, Ontario, and was collected by Mr. W. A. Johnston. The horizon is the "Cystid beds" in the "Prasopora zone" of the Trenton. The same form has been found in the "Prasopora zone" at Fenelon Falls and Brechin, Ontario, and in the "Cystid beds" at Ottawa and Hull.

LEBETODISCUS PLATYS SP. NOV.

(Plate 1, fig. 5).

This species is based upon a single specimen which has long been in the Museum of the Geological Survey. It is imperfect, having been cut off by a joint along the anal side, thus losing the distal ends of rays I and V. The specimen is otherwise quite well preserved. The outline is rounded pentagonal and the rays are long, reaching nearly to the margin. The rays are nearly straight, though the anal rays probably curved toward each other somewhat, partially enclosing the anal structures. Such a curvature is suggested by such parts as remain. The anal structure is entirely missing, but it would appear to have been small and far from the mouth. The inter-radial spaces are covered with small, thin imbricating plates, those near the margins being much larger and stronger than the others. The plates along the rays alternate in position, there being about twenty-four to twenty-six pairs. The inner ends are diagonally truncated and pointed, so that, where undisturbed, they fit together very closely. Where they have been displaced, as is the case with most of the arms, they are somewhat drawn apart, and thus leave alternating openings.

The plates above the mouth are like those in *L. billingsi*, the anterior pair between rays II and III, and III and IV, being clearly seen, and the posterior one less distinctly. At the end of each ray is a small, central terminal plate, suggesting the ocular of a starfish.

The greatest diameter is 24 mm.

This species is quite like *L. chapmani* but differs from it in its larger size, longer and more slender arms, less circular outline, and the curvature of rays I and IV.

Horizon and locality:—The type and only known specimen (No. 7941, Vict. Mem. Mus.) was collected at Ottawa by the late T. C. Weston in 1881. It is presumed to be from the "Cystid beds," probably from the foot of Parliament Hill or Queen's Wharf.

LEBETODISCUS MULTIBRACHIATUS SP. NOV.

(Plate 1, fig. 2).

This is a small *Lebetodiscus*, and remarkable for the possession of eight rays, instead of the usual five. Rays I and V are far apart and curve somewhat toward each other, thus partially embracing the anal area. All the other rays are approximately straight. Rays I, II and IV, are all bifurcated, I and II near the center, while IV bifurcates half way between the center and the margin. The disc is not symmetrical, ray III being crowded to the right of its normal position, and rays I and II taking up as much space as rays III, IV, and V. All the rays are short and the border outside them is wide, with rather large imbricating plates opposite the inter-ambulacral areas, and a margin of small plates outside. The supra-oral plates are of the simple type of *L. billingsi*, *chapmani*, *youngi* and *pileus*, No. 5 being a large, wide plate, and the two plates anterior to it small. The inter-ambulacral areas are small, and are covered with small plates. Unfortunately the anal area is not well preserved. The type is 10 mm. in diameter.

This form, since it has numerous arms, naturally suggests the recently described *Thresherodiscus ramosus* Foerste, but is really not allied to that species, which has three primary rays, all of which bifurcate at least twice. The present species is much more closely allied to *L. chapmani* and to *L. billingsi*, and when first noted several years ago, was supposed to be an abnormal specimen of one of these species. It is of interest to note that this form is found at the same horizon, the "Crinoid layers" (Hull or Curdsville formation) in the lower part of the Trenton, as *Thresherodiscus ramosus*, these being the oldest of the *Agelacrinitidae*. Unfortunately the specimens found at Kirkfield are usually very badly preserved, so that it is not known how many of the specimens so far found are to be referred to this species. A second specimen seems to have only six rays, and the normal number may prove to be seven.

The holotype is No. 7789 in the Victoria Memorial Museum, and is from the Crinoid beds (Hull formation) at the Kirkfield Lift Lock, Ontario.

LEBETODISCUS INCONDITUS SP. NOV.

(Plate 1, fig. 1).

This is the form which is so common in the "Cystid bed" below Parliament Hill and at Queen's Wharf, Ottawa, and which has always been identified as *Agelacrinites billingsi*. It differs in several respects from that species.

DESCRIPTION.

Specimens circular in outline with a broad border of small plates. Rays five in number, rather stout, broad at the proximal end and tapering rapidly. They are almost straight in small specimens while in large ones they are slightly curved, four of the rays having a contra-solar turn, and the fifth curved a little in the opposite direction, so as to embrace the posterior inter-radius. In some specimens, rays I, II, and III, are contra-solar, and IV and V solar, while in the one selected as the holotype, IV is almost straight. The rays bear short interlocking lateral covering plates, about twelve to fifteen pairs to a ray. Median covering plates have not been seen. An appearance of unusual width is given to the rays by the fact that the plates of the inter-radii which abut against the rays are somewhat higher than the remainder of the plates of the inter-radial spaces.

The supra-oral area is large, and covered by numerous small plates. Their arrangement is difficult to make out, because of the way the inter-ambulacral plates are mixed in with ray and supra-oral series. In the center of the disc there appears to be a central plate dove-tailing with two plates which are between rays I and V, and abut on the posterior inter-radius. At the sides and in front of the central plate are five more small plates, one on each side and three in front of the central plate. Two of the plates are inter-radial in position, one between rays II and III, and one between III and IV. This is on the type. On the small specimen next to it in the figure, there seem to be only five plates which really belong to the supra-oral series, the central, two posteriors, and two anterior laterals, between rays II and III and III and V.

The inter-radial areas are covered with small imbricating plates, the plates of the inner part of the outer marginal band being somewhat larger and wider than the plates between the rays. The posterior inter-radius is wider than the others, and the anal pyramid is large and distinct. It is situated a little more than half way from the center to the margin, and is composed of a ring of seven or eight long triangular plates. In some specimens it is situated half way between rays I and V, while in others it is eccentric, and nearer V than I, as in the type.

The holotype is a large specimen, 15.5 mm. in diameter. Other specimens on the same slab with it (all figured) are 11.5, 10, and 9 mm. respectively.

This species differs from *L. dicksoni* in having shorter rays, one or two of which are solar, and in having much smaller interradial plates. It is most like *L. platys*, but has more numerous supra-oral plates. While small specimens of *L. inconditus* have straight, broad arms, they may readily be distinguished from *L. billingsi* or *L. youngi* by the more numerous supra-oral plates.

Horizon and locality:—This species is common in the "Cystid bed" in the "Prasopora zone" on both the Ottawa and Hull sides of the Ottawa River. It occurs at Peterboro also.

The holotype is No. 1409 in the Geological Survey Museum and was collected by Mr. T. C. Weston. It is undoubtedly from the "Cystid zone" at Queen's Wharf, Ottawa, Ont.

EXPLANATION OF PLATE.

1. *Lebetodiscus inconditus* Raymond. Four specimens in natural position, resting on the sea bottom, showing that they were not attached to shells or other objects. With the decay of the animal the central portion sinks in, leaving an elevated ring of marginal plates. The largest specimen is the holotype. x 1.5.

2. *Lebetodiscus multibrachiatus* Raymond. The holotype, showing the branching arms. The specimen does not lend itself readily to photography. x 3.8.

3. *Lebetodiscus chapmani* Raymond. The holotype. x 3.

4. *Lebetodiscus youngi* Raymond. The holotype. x 3.8.

5. *Lebetodiscus platys* Raymond. The holotype. x 1.5.

6. *Lebetodiscus loriformis* Raymond. The holotype, a large part of the surface of which is concealed by shale. x 2.8.

Figs. 1 and 5 were made at the Geological Survey photographic laboratories. Figs. 2, 3, 4, and 6 were made by Mr. Nelson at the Museum of Comparative Zoology, through the kindness of Director Samuel Henshaw.

MINERALS FROM BAFFIN LAND.

BY T. L. WALKER, UNIVERSITY OF TORONTO.

The Royal Ontario Museum of Mineralogy has recently received from R. J. Flaherty, Esq., M.E., of the North Lands Exploration, Limited, a fine series of minerals collected by him on his recent visit to Baffin Land. Most of the material came from near the shore to the south of Amadjuak Lake.

The geological character of this region is indicated in the following passages from the reports of Dr. Robert Bell*;—

> "The distinguishing feature in the geology of the southern part of Baffin Land is the great abundance, thickness and regularity of the limestones associated with the gneisses. At least ten immense bands, as shown on the accompanying may, were recognized, and it is probable that the two others, discovered in North Bay, are distinct from any of these. There would, therefore, appear to be twelve principal bands as far as known, to say nothing of numerous minor ones, between Icy Cape and Chorkback Inlet. The limestones are for the most part, nearly white, coarsely crystalline and mixed with whitish felspars. The individual crystals in some parts of the limestone masses would measure two or three inches in diameter and the crystallization of the felspar is occasionally equally coarse."
>
> "The limestones usually contain scattered grains of graphite and among the other minerals which commonly occur in the various bands are mica, garnet, magnetite, pyrite, and hornblende. Serpentine of a dark colour was abundantly disseminated as grains and small irregular masses in a band which crosses the head of Canon Inlet. Disseminated specks of bright green and blue serpentine were found in another band at White Bluff Harbour and similar specks of both colours occur in the eastern band at the head of North Bay. The late Mr. Ashe gave me a crystal of sphene, an inch and a half in diameter, which had been brought to him by an Eskimo from North Bay—probably obtained from the limestone there."

The series of minerals contained in Mr. Flaherty's collection is such as might be expected from an archaean region where cyrstalline limestones alternate with gneiss in a great complex. In many respects the collection suggests the mineral association found in Ottawa County to the north of the Capital.

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* Report Geol. Survey of Canada, New Series, Vol. XI., p. 24M.

SCAPOLITE, Macdonald Island.

This mineral occurs in crystals some of which are five inches in diameter. The only forms observed are the prisms (100) and (110) and the unit pyramid of the first order (111). The mineral is white in colour and possesses a vitreous lustre.

ROSE QUARTZ, Amadjuak Bay.

The specimens of this mineral consist of a large number of fragments devoid of crystal form and varying in colour from deep rose to colourless. It is worthy of note that those fragments spotted by lichens and evidently from the very surface are either very pale rose or colourless, while the deeper tinted specimens are usually free from lichens. This contrast seems to give support to the view commonly held as to the gradual bleaching of rose quartz when exposed to bright sunlight.

GRAPHITE, Amadjuak Bay, North side; Fair Ness.

This mineral has been reported from this region by several explorers. The graphite from Amadjuak Bay consists of large, flat cleavage plates sometimes two inches in diameter. That from Fair Ness is very pure and more or less coarsely fibrous. The quality of the graphite from both localities suggests the possibility of commercial development in case the deposits are of sufficient dimensions.

GARNET, Garnet Island (about Long 72° 30′, Lat. 63° 45′).

The rock in which the garnet occurs is somewhat schistose, fine grained and consists almost entirely of small scales of dark biotite and felspar which the microscope shows to be microperthite. The felspar constitutes at least nine tenths of the rock. The garnet is found only in the form of large, more or less rounded crystal masses sometimes four inches in diameter. It possesses a fine, deep blood red color and is so free from cracks that some at least could be used for gemstones.'

OPHICALCITE.

Pure white calcite is mixed with about an equal amount of very beautiful sulphur yellow serpentine which is remarkable for the uniformity and delicacy of its colour. Unfortunately, the exact locality of this exceedingly beautiful ornamental stone is not available.

SERPENTINE.

This material is greyish, greenish or yellowish in colour, fine grained and massive as a rule but sometimes intersected by veinlets of chrysotile.

PHLOGOPITE.

The colour of this mineral varies from amber brown to a almost white. The largest crystals are about four inches across but are too imperfect to be of economic value.

DIOPSIDE, Macdonald Island.

Crystals of diopside sometimes three inches in length occur in calcite. They are olive green in colour with very fresh, brilliant surfaces in the prism zone while the terminal faces are often rounded and even corroded. The habit of the crystals is peculiar in that the most prominent end face is the positive orthodome (I01). Basal cleavage or parting is so well developed that most of the crystals have been broken across showing very smooth cleavage surfaces. The material is much brighter and fresher than the diopside found to the north of the city of Ottawa. Owing to the unusual crystal habit and the degree of corrosion this mineral merits further study.

SPINEL, Locality unknown.

The mineral occurs in the form of octahedra whose edges are sometimes truncated by the rhombic dedecahedron. The largest crystals are about half an inch in diameter. The crystals are lilac in colour but too much fractured to be of value for gem purposes.

CORDIERITE, Garnet Island (Long 72° 30′, Lat. 63° 45′).

The specimens of cordierite consist of irregular fragments of vitreous lustre which are sometimes two inches in diameter. It is associated with white felspar rock and probably occurs as lenses in gneiss. The mineral is deep blue in colour and some of the fragments are sufficiently free from flaws to suggest its use as a gem mineral. Cordierite has up to the present been a very rare mineral in Canada so that its discovery in Baffin Land has considerable mineralogical interest.

In thin sections under the microscope the mineral is seen to be polysynthetically twinned so that it is difficult to believe that the section is not composed of plagioclase. A subordinate part of the cordierite consists of an intimate intergrowth of twinned mineral in which the two portions present a vermicular intergrowth.* It is also characteristic that though the cordierite as seen in thin sections there are distributed many small inclusions of rutile or zircon, each of which is surrounded by a deep pleochroic aureole, orange in colour.

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* Walker and Collins., Rec. Geol. Survey of India, Vol. XXXVI., p. 1.

ACTINOLITE, West side of Ottawa Island, Hudson's Bay.

This mineral approaches the variety asbestus but it is too splintery to be of commercial value. It is greenish grey in colour. The fibrous masses are sometimes six inches in length. It will be noted that this mineral is found in quite a different region from the others referred to in this paper.

The chief points of interest connected with this series of minerals are:

1. The remarkable agreement between the variety of minerals found in south Baffin Land and those found in other regions where crystalline limestones form a prominent part of the gneiss complex.
2. The presence of cordierite, spinel, garnet, rose quartz and ophicalcite suggests that in the future Baffin Land may produce minerals valued for ornamental purposes.
3. Mica, graphite, serpentine and actinolite are minerals frequently mined economically.

UNIVERSITY OF TORONTO,
JUNE 15th, 1915.

QUEBEC DRAGON-FLIES.

BY REV. T. W. FYLES.

A few weeks ago I had the pleasure of a visit from Prof. E. M. Walker, editor of the "Canadian Entomologist." Dr. Walker is an authority on the Odonata, and he kindly examined some of the dragon-flies taken by me in Quebec Province. He identified several of them, and verified the names of the rest. The following is a list of the insects, giving the locality in which each was taken. It should be regarded as an appendix to my paper on the *Dragon-flies of the Province of Quebec*, which appeared in the 31st Annual Report of the Entomological Society of Ontario.

LIST.

Names.	Localities.
AGRIONIDÆ.	
Calopteryx maculata Beauv.	"The Beaver Meadow," Hull.
" *æquabilis* Say.	Cowansville.
" *amata* Hagen.	St. David's, near Levis.

LIST—continued

Names.	Localities.
Lestes unguiculatus Hagen.	"The Beaver Meadow," Hull.
" *disjunctus* Selys.	"
Amphiagrion saucium Burm.	"
Ennallagma hageni Walsh.	"
" *calverti* Morse.	"
" *exsulans* Selys.	"
ÆSHNIDÆ	
Ophiogomphus rupinsulensis Walsh.	"The Gomin," Bergerville.
Gomphus brevis Hagen.	"The Beaver Meadow," Hull.
" *vastus* Walsh.	Levis Heights.
" *notatus* Ramb.	Hull.
Cordulegaster diastatops Selys.	"
Boyeria vinosa Say.	River St. Charles, Quebec.
Æshna sitchensis Hagen.	Island of Orleans.
" *eremita* Scudder.	"The Beaver Meadow," Hull.
" *canadensis* E. Walker.	"
" *umbrosa* E. Walker.	"
" *constricta* Say.	Island of Orleans.
Anax junius Drury.	"Mer de Papon," Levis.
LIBELLULIDÆ.	
Didymops transversa Say.	Levis Heights.
Macromia illinoiensis Walsh.	"
Tetragoneuria cynosura simulans Muttkowsky.	"The Gomin."
Tetragoneuria canis Maclachlan.	"The Beaver Meadow."
Libellula quadrimaculata Linneus.	"The Gomin."
Libellula pulchella Drury.	"Mer de Papon," Levis.
" *lydia* Drury.	"The Beaver Meadow."
Leucorrhinia intacta Hagen.	Bergerville.
" *proxima* Calvert.	"
" *hudsonica* Selys.	"The Beaver Meadow."
Sympetrum costiferum Hagen.	"
" *obtrusum* Hagen.	"
" *vicinum* Hagen.	"
" *scoticum* Donovan.	"The Gomin."

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To be continued.

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THE DANGERS OF OUR WILDS.

By Charles Macnamara, Arnprior, Ont.

The French traveller, lately returned from Algeria, was frankly joking when he told an enquirer that the most dangerous animal in North Africa was not the lion, as generally supposed, but the gazelle. "The lion," he said, "it never molests you. But the gazelle, when you are riding across the plain, suddenly springs up at your horse's nose; your horse shies, and throws you off and you break your neck." While this was admittedly a pleasantry on the part of the traveller, a consideration of the dangers of our native woods leads to a conclusion almost as surprising.

In the first place, the only real menace to human life comes, not from the animals of our forests, but from the plants. Our woods and fields harbour a far larger number of poisonous plants than is commonly suspected. Everyone knows of poison ivy and the painful and annoying skin eruption it causes; but its effects, however unpleasant while they last, very rarely result in any serious or permanent injury. Much more grave are the consequences of the internal poisonings by plants which attract by their succulent roots or bright-coloured berries. To mention only a very few of the commonest of these, the sweet roots of the hemlocks, *Conium maculatum* and *Circuta maculata*, are most deadly, and the rash partaker seldom recovers. Another plant with a bad record is Indian tobacco, *Lobelia inflata*, which grows plentifully in dry fields. Although it has a strong and disagreeable taste, children, misled by the common name, sometimes chew this weed with fatal results. The bright red pulp enclosing the seeds of the yew, *Taxus bacata*, found all through our woods, is probably harmless enough in itself, but the seeds are very poisonous. The vivid colour of the "berries" makes them attractive to children, and a good many young lives have been sacrificed to them.

But the fungi of the genus *Amanita* have more deaths against them than all the rest of our flora put together. Never a season passes without one or more records of persons fatally poisoned by these pleasant-tasted but deadly mushrooms. In this connection it may be worth while mentioning that the popular tests of the edibility of mushrooms, such as the blackening of silver during cooking, the change of colour of the flesh when broken, easy peeling of the skin, and a host of others, are all perfectly worthless, and the mushroom eater who relies on them is in mortal peril of his life.

When we turn to the animal life of our wilds we find no such deadly enemies as these. Although our fauna includes a number of large mammals and about a dozen species of snakes, it can be stated with the utmost confidence that, with the single exception mentioned later on, no animal of Eastern Canada ever makes an unprovoked attack on man, and very few of them indeed show any fight even when brought to bay.

Considering first some of the lower forms, it may be remarked that in many countries, insects are to be counted among the worst foes of mankind. The pestiferous mosquitoes of the tropics and sub-tropics, the tse-tse fly of Africa, and the flea that spreads the bubonic plague are best known examples. We have our share of biters and blood-suckers,—deer flies, black flies, sand flies and mosquitoes,—and it is hard to think of anything kind to say about them. They make life in the woods miserable during the finest season of the year; but annoying as their attacks are, at least we must admit that they do not inoculate us with yellow fever or malaria, sleeping sickness or the plague.

Our ophidia comprise about a dozen species. The only venomous one of these, the rattle snake, once common in Western Ontario, is now practically extinct there, and as far as I know, never lived in the Ottawa district at all. Without exception, the other species are perfectly harmless. Some of them, such as the milk snake, live almost exclusively on rats and mice. Others are largely insectivorous, and all of them serve a very useful purpose in helping to maintain that balance of wild life that man sometimes disturbs with such dire consequences to himself. One must then deplore the wanton cruelty and gross superstition that prompt so many people to kill these harmless and beautiful creatures at sight.

The catalogue of mammals of Eastern Canada recites such formidable names as the cougar, the wild cat, the lynx, the bear, the wolf. But it is not among these that our "dangerous" animals are to be found. The cougar, which reached the extreme northern limit of its range in Southern Ontario, has long been extinct in these regions, and while a powerful animal and very destructive of deer and domestic live stock, was never known to attack man. The wild cat, *Lynx rufus*, is also extinct and was never more to be feared than the harmless necessary domestic variety. The lynx, *Lynx canadensis*, is still fairly common in our northern woods, and despite the blood-curdling stories of some of our nature fakirs, it is a most innocuous creature, living largely on hares and as averse to fighting as the Hon. W. J. Bryan. The bear, *Ursus americanus*, would doubtless defend itself if cornered, but when it meets a man its first impulse is instant flight. A she-bear with cubs generally waits to cover the retreat of her young, but I never heard of one taking the offensive.

And what of the ravening wolves that,—in newspaper stories,—hunt in fierce packs, and devour hapless hunters and trappers? There are certainly plenty of wolves in the back woods, and they destroy large numbers of deer and in some districts kill the young cattle of the settlers. But the cold truth, well known to every woodsman, is that the Canadian timber wolf, large and powerful animal as it is, never attacks anyone. The ordinary farm dog is a far more formidable animal. The wolf is exceedingly wary and has an overwhelming distrust and fear of man and all his works. Anything that man has touched or handled inspires dread in the wolf. Consequently it is very hard to trap or poison him, and even harder to get a shot at him. Although always apparently half famished, he will prowl for days around a dead horse before he dares to feed on it, his exceedingly keen scent warning him that his dread enemy, man, has had something to do with it. Every hunter knows that it is quite safe to leave the carcass of a deer hung from a low branch anywhere in the woods. If there is snow on the ground, the tracks of wolves will be seen all around the suspended game, but not one of them will venture to touch the meat tainted for them by the contact of man. Much less likely are they to attack man himself, and all the stories of their treeing or devouring woodsmen should be catagorized with the German statements as to the causes of the war.

The moose is not at all pugnacious, but it is much more respected in the wilds than the wolf. It is not a particularly timid animal, and impelled by curiosity, it sometimes approaches the woods traveller quite fearlessly, its imposing bulk making it appear decidedly formidable. As far as I know, there is no record of anyone ever having been hurt by a moose, but occasionally its threatening attitude causes an unarmed man, perhaps unduly alarmed, to take to a tree. A friend told me recently of a curious display of woodcraft in connection with an obstinate moose. My friend, who was without a weapon of any kind, was crossing a portage in the Kipawa district last summer with his Indian carrying the canoe on his head as usual, when they suddenly came on a large moose standing in the narrow pathway. The animal showed a determined front and apparently intended to dispute the right of way. It was hard to see how he could be driven off without running the risk of a savage kick, but the Indian, wise in forest lore, knew a safe and easy way. He slipped one end of the canoe to the ground and still supporting the other end on his head, drew his pipe and a match from his pocket. Quickly lighting the pipe, he blew a cloud of tobacco smoke down the wind towards the moose. One whiff of the "tabac canadien" was enough for the King of the Forest and he dashed off into the woods.

Then if our snakes, bears and wolves are all perfectly harmless, what are our "dangerous" animals? Well, as already stated, none of our fauna ever really menace human life; but there are two denizens of the Canadian woods that, though they do not ordinarily command any respect, I am inclined to treat with considerable circumspection. These are the skunk and the horned owl.

The skunk when undisturbed is really a well-disposed and unoffensive little animal. It is never the aggressor as far as mankind is concerned; but it has justifiably great confidence in its peculiar means of defence, and so it stands firmly on its rights and is very loath to make way for anyone. When it thinks it is being imposed on, it takes the literal offensive in a most effective manner, and an incautious approach always results in the loss of a suit of clothes to say nothing of one's dignity.

The horned owl is a much more dangerous enemy than this. It is, indeed, the only creature in our woods that ever makes an unprovoked attack on man. True, it has nothing against man personally, and its assaults are always the results of a misapprehension, but nevertheless it sometimes inflicts painful wounds. Like all its race, it is nocturnal in its habits, and its usual mode of attack is to swoop down in the dusk on the head of the passerby, its long claws causing severe lacerations. It is evident that the bird from its elevated outlook sees the moving figure of the man beneath it very much foreshortened, and mistaking a shock of hair or a fur cap for one of the small animals on which it usually preys, it pounces on its victim. In his most interesting book "Sport and Life on the North Shore" Napoleon Comeau records a number of instances of such onslaughts by the horned owl. I know a man who bears a large scar on his forehead as a consequence of such an encounter, and there are many well authenticated stories of shantymen having been attacked. At one camp it is said that the owls were so plentiful and aggressive that the teamsters had to wear half a pork barrel over their heads when going out to the stables in the dark, but I do not vouch for the terminological exactitude of that story!

But after all, such adventures are very rare, and it may safely be said that the benighted traveller can lay his head anywhere in the woods of Eastern Canada in perfect security from venomous reptile or predacious beast; and with the exception of annoying insects at certain seasons of the year, he need "fear no enemy but winter and rough weather."

BIRD NOTES FROM MULVERHILL, MAN.

THE BLUEBIRD, *Sialia sialis*. In this district, during last summer, I did not meet a single one until fall. One day in the autumn, a flock of some twenty birds (mostly young ones) appeared near my home. They remained about half a day and then disappeared. I came to the conclusion that they had been breeding further north, and were on their way south.

CANADA JAY, *Perisorcus canadensis*. During last summer several pairs stayed with us all the summer. This season I have not seen a single one.

NORTHERN PILEATED WOODPECKER, *Phaeotomus pileatus pileatus*. During last summer at least two pairs stayed in our poplar bush all the season. This summer not a single one has been seen.

GREATER YELLOW LEGS, *Totanus melanoleucus*, and LESSER YELLOW LEGS, *Totanus flavipes*. Contrary to the general rule of both, these sister waders have been here in large flocks all this spring. Saw several of them on June 9. Last year I did not see a single one of either variety until late in the fall, when the migrants came down in flocks from the north. I found the nest of a Yellow Legs on June 24, less than a mile from my house.

CANADA GOOSE, *Branta canadensis*. Last year they all passed by both spring and fall; this year at least two pairs are staying in the big marsh in the middle of Birch Lake, evidently breeding.

ERNEST NORMAN.

August, 1915.

MIMICRY—SOME OF NATURE'S STRATEGEMS.

By B. C. Tillet, Hamilton, Ont.

Nature teems with instances of what are called mimetic resemblances, instances of organisms closely imitating their neighbours for the sake of some advantage to be gained thereby. Thus is instituted a sort of system of false pretences, an elaborate series of confidence tricks which in their most interesting examples have the merit at least of being defensive rather than aggressive. It is rather curious that while protective colouration in the general sense has certainly been elaborated, not only for defence but for attack also, that manifestation of it, technically termed mimicry, seems to have been developed solely for the purposes of defence and escape.

The gradation between ordinary protective colouration and the most highly specialised form of mimicry is practically complete. Our green caterpillars, our butterflies with brown undersides to their wings, the colouring of certain birds, and the markings of certain birds' eggs, are all instances of ordinary coloured organisms. They do not resemble anything in particular. Their colours are such that in most of their daily circumstances they harmonise in a general sense with their surroundings, thus ceasing to be specially noticeable, at any rate so long as they are at rest. A further step is illustrated by the caterpillars of those geometers usually called stick-caterpillars. These caterpillars are of such form and colouring that when stretched out stiffly, they have a strong resemblance to short dead twigs, sometimes even with buds and leaf-scars complete; while, to render the illusion quite perfect, they have also acquired the habit of resting in just the very poses that twigs might themselves take up. No better example of this can be found than the caterpillar of *Ennomos magnarius*, which when poised by the hind feet on a twig, with the body thrown backwards into space, may well escape detection by all except the keenest observer. Perhaps one of the most remarkable examples of special protective resemblance is seen in the leaf butterfly of Malay, *Kallima paralecta*. The wings of this insect so exactly resemble a leaf when closed, that it may pass altogether unnoticed. We find an elaboration here again of the protective instinct. These insects have a rapid flight, but they will drop suddenly and closing their wings as they alight, take on all the appearance of a leaf. Thus, they seem to completely vanish. The protective instinct may be observed in many insects. A butterfly which has been captured, fearing destruction, will lie prone on its side; moths, too, will mimic death by lying on their backs. Beetles will feign death in the same way.

Battle within battle must, Darwin says, throughout nature, be continually recurring with varying success. The weak suffer at the hands of the stronger, and they, having no other means of protection against a stronger enemy, have recourse to various strategies. If the caterpillar does not exhibit the protective resemblance, it may be it is unnecessary, that there are other means of protection existing. There are, for instance, many caterpillars that may be said to be quite conspicuous by their brilliant colouring. But no bird will touch them. Their safeguard, no doubt, is that they taste nasty, and their bright colours thus serve to protect them. Other forms of insect life escape elimination through the development of offensive weapons, such as the sting of wasps and bees. Animals which prey upon these forms learn to avoid them, and thus it becomes an advantage to other insects not possessing such means of protection to mimic them. And so we have that venomous-looking insect the great *Sirex gigas*, and the clear-wing hornet moth, *Sphecia apiformis*, with its abdomen arrayed in the bright colours of the hornet, and its sting-like projection and ovipositor. Yet this is a quite inoffensive and harmless insect.

As in the case of protective resemblance, so too, in its aggressive correlative, the resemblance may be general or special, or may reach the climax of mimicry. Hence, what may serve as a protective resemblance, may also enable the prey to steal upon its enemy. The cuckoo bee *Psithyrus rupestris*, an idle queen, who collects no pollen, and has no pollen baskets, steals into the nest of the bumble bee and there lays her eggs. So great is the resemblance here, that not only is the mother bee able to enter the nest unchallenged, but the young bees when hatched are by the same means enabled to escape. Our various bumble bees, no doubt, find great advantage in so closely resembling one another. Many other insects, too, find equally great advantage in so closely resembling the bumble bees. Many common flies mimic them, and each colour type of bumble bee has its appropriate mimic. Certain bees, called Apathi, are parasitic in the nests of the bumble bees. They are indeed very much like real bumble bees, from which they may be distinguished by the thinness of their fur and the consequent shining appearance of their bodies. These very large bees have precisely the colouring of the true bumble bees. Some are parasitic in the nests of those bees which they resemble in colour, and it may be that this resemblance assists them in entering the nests. Hence, it would seem that the mimicry is not so much an aid to the imposition upon the bumble bees, as a means of protecting the Apathi from the general enemy. The honey bee has, of course, many mimics, of which the common drone fly is a familiar instance.

Nor is protective resemblance confined to invertebrates. We find it in animals, birds, fish and various reptiles. The wild rabbit is a common example of it. Not so common, but a more striking instance of it, may be found in the zebra. Travellers in Africa have found themselves at night in the presence of zebras, and only been aware of the fact by their breathing. Had the zebras been black, or had they been white, they would have been easily visible, but in the starlight night, the combination of black and white stripes blend exactly with the twilight, and so render them invisible.

Some animals, moreover, possess a variable protective resemblance. We have an example of this in the chameleon, which adapts its colours according to its surroundings, an adaptation which is brought about by the expansion and contraction of certain pigment cells. The same phenomena may be observed in the Arctic hare, and the Arctic fox, animals which change their colour according to the season, brown in summer, and snowy white in winter. Among birds numerous instances of protective resemblance may be noticed; and so too with the eggs of many of our wild birds, which so closely resemble the shingle in which they are laid as to be unnoticeable.

Thus we find that there are two kinds of mimicry. In the one the mimic is really weak and defenceless, but by assuming the appearance of some better armed and perhaps savage species, acquires also the latter's evil reputation. This is called Batesian mimicry. In the other we have the real hard cases, creatures which are as well protected by unamiable qualities as they well can be; and which imitate equally disagreeable beings merely for the sake of the additional free advertisement of their ill qualities which the latter afford. This is called Mullerian mimicry.

Mimicry depends for its effective expression upon the power that all the higher animals have of memorizing their experiences. The puppy which captures the bee and is stung learns to avoid such dangerous playthings. In this way the death of one or two individuals frees the whole species from danger of attack by that particular puppy. Moreover, any other kinds of bees, or of other insects resembling in appearance the first one, would also be looked upon with suspicion and avoided. So that the deaths of these one or two individuals would have the effect of protecting every kind of insect that resembled them in appearance.

BOOK NOTICE.

The Dominion Parks Branch of the Department of Interior, Ottawa, has recently issued three publications which are noteworthy on account of the attractive form in which they are printed, and the interesting matter they contain. They are: "Classified Guide to Fish and Their Habitat, Rocky Mountains Park"; "The Nakimu Caves"; and "Glaciers of the Rockies and Selkirks."

The Fish Guide is written for the sportsman and naturalist rather than the scientist. It is a compilation of first-hand information for anglers by one who has fished in all the principal waters of the park. It takes up each locality, describes the best means of reaching it, the different varieties of fish which can be secured, and the best bait to use. The game fish of the Rockies include five species of trout, one of which—the Lake Minnowanka trout—has been known to run as high as 50 pounds. The Grayling, the Dolly Varden, and the Cut Throat trout are found in many of the lakes and streams of the park, and a fish hatchery has recently been established at Banff for the purpose of restocking those which have become depleted.

The second pamphlet gives an interesting account of the formation, character and discovery of the famous Nakimu Caves near Glacier, B.C. These interesting natural curiosities are supposed to be about 40,000 years old, and consist of a series of underground chambers, some of them fifty feet high and more than two hundred feet long, hollowed out partly by erosion and partly by volcanic action, and opening into each other at different levels. The walls of the caves are covered with strange florescent limestone formation, and they reverberate to the roar of underground torrents. The different chambers have been given names suggestive of their character: "The Pit," "The Marble Way," "The Ballroom," "The Art Gallery," "The Judgment Hall," "The White Grotto," "The Bridal Chamber," etc., and when they are lit with electricity, and proper guards and handrails have been placed on the stairs and platforms, they should be among the most interesting sights in the Rockies for tourists.

"Glaciers of the Rockies and Selkirks" is by Dr. A. P. Coleman, Professor of Geology in the University of Toronto, and bears on the cover an attractive reproduction in color of a sketch of Mt. Ball, one of the picturesque peaks near the Divide. Dr. Coleman is a scientist with the imagination of a poet, and he has written the story of the formation and work of the Canadian glaciers with all his well known literary charm. The pamphlet should prove not only a great help to the student of glacial phenomena who visits the parks, but it should inspire many Canadians with a desire to see the wonderful mountain scenery of their own country for themselves, "to put on," as Dr. Coleman says, "warm, strong clothes and hob-nailed shoes, and to fill one's lungs with mountain air in a scramble up to the snow fields to see how the glacial machinery works."

The pamphlets may be obtained free on application to the Dominion Parks Branch, Ottawa.

A HYBRID ROSE.

ROSA GYMNOCARPA NUTT. x R. NUTKANA PRESL.

Stems rather slender, 1.3—2 m. high; prickles below densely soft-prickly, slightly retrorse, above slender but stiff; leaflets simply serrate, 1—2.7 cm., broad, oval, rounded at both ends, glabrous beneath; stipules broad; flowers mostly in clusters of 2—4 or solitary, bright pink with pink stigmas 4—4.5 cm. broad; calyx more or less glandular, persistent, the appendages 5—15 mm. long; receptacle at flowering 3—6 mm. in diameter; pollen scanty and abortive; fruit mostly not developing, the few seen 7—8 mm. in diameter, producing few nutlets.

Several clumps of this rose occur near Crescent Beach, B.C., at the base of a bluff facing Boundary Bay. The bushes, with their rather slender flourishing stems, rising somewhat above the surrounding *R. nutkana*, look much like *R. pisocarpa*, especially as the flowers are mostly in small clusters, and smaller than those of *R. nutkana*. *R. pisocarpa*, however, does not occur in the immediate vicinity, and does not flower till late in June. The plant just described flowers with *R. nutkana* and *R. gymnocarpa*, all three being in full bloom May 20, 1915.

The clustered flowers, the prickles and the glabrous leaflets, suggest *R. gymnocarpa*; the large leaves and the glandular persistent sepals, *R. nutkana*. With its long, rather slender, very floriferous stems and bright flowers, this is a most attractive rose. It is readily, even at some distance, distinguished from *R. nutkana*, by which it is surrounded, by the brighter pink petals.

J. K. HENRY.

NOTE.

In Mr. P. A. Taverner's article, "Geological Survey Museum Work on Point Pelee, Ont.," published in the November, 1914, issue of THE OTTAWA NATURALIST, the year in which the observations recorded therein were made is not mentioned. This was 1913. Ornithologists please note.

PARTIAL LIST OF LITERATURE IN THE LIBRARY OF THE OTTAWA FIELD-NATURALISTS' CLUB.

(*Continued from page* 68.)

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THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The fifty-second annual meeting of the above society will be held in Ottawa, on November 4th and 5th, 1915. The day sessions will be held in the large laboratory of the Entomological Branch, Department of Agriculture, Birks' Building, Sparks street, and the evening meeting on November 4th in the Assembly Hall of the Normal School. At this latter meeting Dr. H. T. Fernald, State Entomologist of Massachusetts, will deliver the popular lecture, the subject of which will be "Life Zones in Entomology and their relation to Crops."

A very full programme has been arranged for the day sessions. Many of the papers to be presented will be of an economic nature, on subjects of extreme interest to the agriculturist, horticulturist, etc. Entomologists from every province in Canada will be present, in addition to which prominent authorities from the United States will also be in attendance. Members of the Ottawa Field-Naturalists Club interested in insect life will be welcomed at the meetings.

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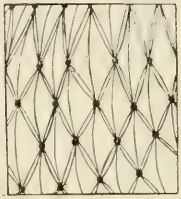

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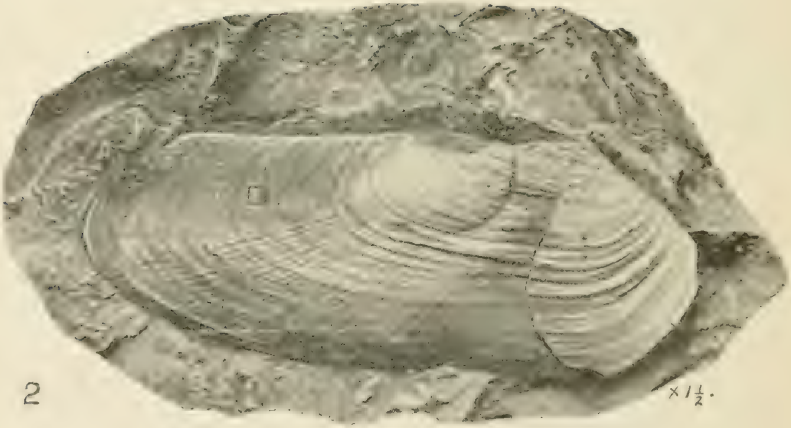

THE OTTAWA NATURALIST

VOL. XXIX. NOVEMBER, 1915 No. 8

A NEW ORDOVICIAN PELECYPOD FROM THE OTTAWA DISTRICT.*

By Alice E. Wilson.

The shell is of medium size and subelliptical in outline, length and height about as 2:5. The valves are very slightly convex. The cardinal margin is straight posterior to the beaks for about two-thirds the length of the shell, making an angle of 45° with the anterior margin, which continues as a straight line nearly to the median transverse axis of the shell, thence curving into the anterior and basal margins. The latter margin bends slightly upward opposite the broad weakly-defined sinus. The posterior end is slightly truncated obliquely, but joins the basal margin with a moderately narrow curve. The anterior margin and the straight cardinal margin form a more obtuse angle than that of the posterior end, and the curve with which it joins the ventral margin is less narrow. There is a slight constriction beneath the very moderately raised umbones. The lunule, which is evidently very narrow, is partially destroyed on the specimen examined. The sinus is very shallow, moderately broad and less oblique than most other species of this genus. The umbonal ridges are not prominent, and become imperceptible in the posterior portion of the shell, which is almost flat. Anterior to the sinus there is a slight inflatation. The concentric growth lines are very fine, but anteriorly they are gathered into about a dozen strong ridges, which end abruptly in the oblique cardinal margin. Posteriorly the ridges of growth lines almost disappear.

The most striking characteristic of the species, however, is the unique marking. A series of fine granules crosses the concentric growth lines, radiating from the umbonal region. Near the beak they are very fine, hardly visible to the naked eye, but they become much stronger away from it, so that in the ventral half of the shell they have almost obliterated the concentric growth lines, except anteriorly where the strong ridges of concentric growth lines are still prominent. On the dorsal half of the posterior portion of the shell there is a still more complex marking. In addition to the very fine concentric growth lines crossed by the radiating series of granules, which here are very minute, there is a very fine double network of lines running obliquely from granule to granule, forming a regular mesh, with one granule at each intersection of the lines. The lines of growth, with a gentle curve towards the posterior margin, pass from apex to apex across the longest diameter of the mesh. Some of this very fine network is worn, and in places the granules appear to be shoved up together, but there is much of it that is remarkably well preserved.

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The length of the right valve, which is the only specimen found, is 53 mm., height 21 mm.

This species closely resembles *Rhytimya oehana* Ulrich, but differs from it in the straight anterior cardinal margin in the narrower and less oblique sinus, with its consequent less sinuate ventral margin, in its narrow and more rounded posterior portion.

It differs from *Rhytimya compressa* Ulrich, in the more abrupt downward slope of the anterior portion of the dorsal margin, in the somewhat more distinct mesial sinus, and the corresponding slight upward flexure of the ventral margin. *Rhytimya cranulosa* is larger, the posterior portion is more prolonged, and the mesial sinus is less oblique.

Compared with *Rhytimya convexa* Ulrich, this species is less convex on the whole, although slightly more inflated anterior to the mesial sinus. The folds of concentric growth lines are less prominent posteriorly and the cardinal margin is straighter.

For this species I would propose the name *Rhytimya granulosa*.

The Museum is indebted to Mr. G. S. Blake, geologist of the Standard Oil Company of Canada, for the shell.

Formation: Lorraine, in the Proetus zone, several hundred feet below the *Strophomena fluctuosa* horizon, which is regarded as near the base of the Waynesville division of the Richmond, by Aug. F. Foerste.

Locality: Twelve miles east of Ottawa, near Vars, on the Grand Trunk railroad. Immediately west of the intersection of the roads between concessions VII and VIII, between lots 20 and 21, nearly two miles west of Vars.

EXPLANATION OF PLATE II.

RHYTIMYA GRANULOSA, N. SP.

1. Portion of network on the upper posterior portion of *Rhytimya granulosa* x ten diameters. The lines of nodes from right to left are the radiating lines shown on the specimen. The single long lines through the long axis of the mesh are the lines of growth.
2. *Rhytimya granulosa*, photograph of type x 1½. Number 4319 in the Geological Survey Museum.

SHALLOW WATER DEPOSITION IN THE CAMBRIAN OF THE CANADIAN CORDILLERA.*

By LANCASTER D. BURLING.

During the field season of 1915, the writer was engaged in a stratigraphic study of the Cambrian rocks along the Canadian Pacific and Grand Trunk Pacific railways in British Columbia and Alberta. One of the most striking features observed was the very considerable evidence of shallow water conditions of deposition in the limestones of the region.

The Stephen formation (*ı*) occupies a central position in the Middle Cambrian and forms a two or three hundred foot shelf between cliffs of massive limestone each a thousand feet or more in thickness. In the vicinity of Mounts Stephen and Field, on the Canadian Pacific Railway, it includes those striking Middle Cambrian faunal horizons to which the terms Ogygopsis shale and Burgess shale have been applied. Here the limestones and shales of which it is composed betray no evidence of shallow water conditions of deposition; in fact it is hard to see how the jelly fish, sea cucumber, sponge, worm, crab, and pteropod fauna of the Burgess shale (*b*) could have been preserved in strata deposited outside of the most sheltered of habitats. In Castle Mountain, 30 miles southeast of the locality to which these faunas appear to be confined, however, the limestones of the Stephen formation, which are both coarse and fine grained and apparently purely calcareous, are very largely mud-cracked and ripple-marked. The areas outlined by these mud-cracks vary from one inch to three or four feet in diameter, and the distance between crests of the ripple-marks varies from one inch to two or more feet, some of the larger ripple-marks being impressed upon layers carrying limestone conglomerate pebbles two inches or more in diameter. Nearly all of these limestones carry an abundant trilobite and brachiopod fauna. Pure limestones carrying what we have been accustomed to regard as marine faunas thus bear unimpeachable evidence that they have not only been deposited under shallow water conditions, but that in many cases they have suffered prolonged exposure to the air. *Glottidia*, *Kraussina*, *Terebratulina*, *Lingula* and *Discina*, among recent brachiopods, are known (*c*) to live at or above low tide, and there is no reason why the extinct trilobite should have needed a deep water habitat. In fact, specimens in our collections show this form to be present upon the surface of interformational conglomerate layers—those curious bands which owe their origin to the edgewise packing and cementing of broken bits of sun-dried crust upon a tidal flat—a characteristically shallow water phenomenon exhibited by limestone strata scores and hundreds of feet in thickness throughout large areas of the Cambrian in Wyoming, British Columbia, Alberta, and Yukon. It may be of interest to record here also the fact that brachiopods and trilobites have been discovered in a massive Cambrian limestone composed almost entirely of Cryptozoon-like algal masses approximating a foot in diameter and six to eight feet in length. The gradually accumulating weight of evidence is thus strongly in favour of the conclusion that neither marine faunas nor limestones are, either of themselves or jointly, a criterion of deep-water deposition, and that for much of the Cambrian the postulation of deep sea basins is unnecessary. Moreover, we have shown this to be true for at least part of a horizon whose faunas preserve their individuality through the one thousand or more miles separating the Nevada localities from those in British Columbia and Alberta. (*d*)

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(*a*) Walcott, 1908, Smithsonian Misc. Coll., vol. 53, No. 5, pp. 209-212.

(*b*) Walcott, Smithsonian Misc. Coll., vol. 57, 1910-1912.

(*c*) Davidson, British Fossil Brachiopoda, vol. 5, 1883, p. 337.

Evidence of shallow water conditions in the Cambrian is most striking, however, nearly 3,000 feet above the Stephen formation at the line separating the Middle from the Upper Cambrian. The base of the Bosworth formation (*e*) in the Canadian Pacific Railway section and the base of the Lynx formation (*f*) in the Grand Trunk Pacific section comprise several hundred feet of red and yellow shales which are covered with mud-cracks, ripple-marks, and casts of salt crystals two inches or more in diameter. The emergence of the sea bottom indicated by these occurences must have been prolonged, but the quiet limestone forming conditions which immediately preceded them soon followed. The occurence is of special interest, because the correctness of the division of geologic time into major units is believed to be confirmed when those units are discovered to represent periods of deposition separated by emergences of the sea bottom.

(*d*) Geol. Survey Canada, Museum Bull. No. 2, 1914, p. 113.
(*e*) Walcott, Smithsonian Misc. Coll., vol. 53, No. 5, 1908, pp. 205-208.
(*f*) Idem, vol. 57, No. 12, 1913, p. 337.

NOTES ON THE HERRING GULL (LARUS ARGENTATUS).

By M. Y. Williams, Ottawa.

Between June 8th and October 26th the writer cruised by launch from Wiarton to Sault Ste. Marie, visiting nearly all the islands included in the Manitoulin group. Throughout the season herring gulls were very numerous. On and after July 21st the immature birds, in brown-gray plumage, began to appear.

These gulls are reported to nest freely on Half Moon Island, where the fishermen obtain plenty of eggs for eating. On July 21st, when we visited Wall Island, I saw old nests, and also a dead, half-grown gull. What appeared to be the remains of a nest was also observed on James Island, and many gulls made it a resting place. This species is also reported to nest on some of the islands in the north channel.

A number of well-informed fishermen and hunters report that the herring gull destroys whole families of young wild ducks. Following the flock as it swims in open water, they hover over the little ducks, which try to escape by diving, and swallow them as soon as they come to the surface.

On September 27th the writer saw a small flock of what appeared to be hooded mergansers off the west end of Barrie Island. Several herring gulls hovered near and dropped to the surface of the water alongside the ducks as soon as they rose to the surface, swam up and appeared to take something away from them. On October 1st a large flock of American mergansers were fishing along the Lake Woolsey side of Indian Point. In spite of a fresh wind blowing on shore, they fished close to shore in the shallow water, following up the innumerable minnows which were to be found at this locality. A number of herring gulls mingled with the ducks, and paid close attention to them as they rose from beneath the water. I shot two of the ducks, and found their mouths overflowing with minnows.

Mr. J. Merrylees, of Gore Bay, hunter and taxidermist, says that the gulls regularly rob the ducks of their fish when they rise to swallow their catch. This appears to be the only conclusion to be drawn from the above observations. It was further stated by Mr. E. Gaulin, of Meldrum Bay, that the gulls rob the loons as well as the ducks.

From evidences seen this summer, the herring gull has at least one dangerous natural enemy. On July 10th the writer discovered four duck hawks along the cliffs of the north side of

Echo Island, which lies but three or four miles north of the Bruce peninsula. The two young birds, which were fully developed, were secured. One was shot from a dead stub at the top of the cliff, which was a much frequented roosting place. Just below were the feathers of blue-jays and the wing primaries of a herring gull. Yeo Island, which was visited July 13th, was also frequented by duck hawks, and numerous wings of crows, gulls and blue-jays lay scattered along the top of the cliffs.

THE EVOLUTION OF THE SHEEP.

By B. C. Tillett, Hamilton, Ont.

To the curious and enquiring mind which first strikes the question, viz: "What are the origins of the domesticated animals and plants of mankind?" there opens out a world of interesting investigation. How did man come to subdue the wild animals of the earth to his uses for labour, for hunting, and for food, and even for fancy and amusement? How came he to discover and cultivate the leaves, roots, seeds, and even the flowers of the vegetable world for food, as well as for ornament and artistic gratification? And, what is more wonderful, how did he multiply and develop from single common stocks all their innumerable and diverse varities? The last question has become, in its biological aspects, a problem so profound and interesting as to develop a new school of inquirers in Europe—the Mendelians.

The Impermanence of Form.

Charles Darwin threw a powerful and important light upon these problems when he demonstrated and developed the simple yet remarkable fact of life, that all living forms existing around us have in reality no fixed permanence. They have all inherent in their nature a vital flexibility of tissue, of anatomy, and of function. And it is this which causes them to fluctuate and vary from those qualities which, in their sum total, go to the make-up of that distinctive type of life we term the species. When the world was young, and reptilian monsters dominated the tropical forests and swamps of the earth, the birds of that period showed their affinities with these creatures in the possession of teeth. The teeth have disappeared, but the population of the air remains. While no living bird now possesses true teeth, within the jaws of an unhatched parrot there are certain microscopic points capped with enamel, which indicate its ancestral connections. They are absorbed before the bird is many days old. In the unborn parrot is the vanishing point of a "missing link" with its primeval progenitors.

With the disappearance of the primeval swamp has also disappeared the five-toed ancestor of the horse. Transferred to the plains, he now races free upon a single digit, developed into a hardened hoof, leaving the vanishing remains of other digits within his pastern to mark the transition of slow development, through æons of time, from one form of life to another. These are instances of a plastic power within the living organism which enables it to fit itself in, and adapt itself to, the exigencies of its environments. The very urgencies of subsistence, and the necessities of survival at Nature's table, demand this constitutional tendency to impermanence of form or function.

VARIABILITY OF NATURE AND LIFE.

For in all her physical aspects, Nature is herself changeable and inconstant. The rigors of her chequered and ever-changeable conditions have aided in eliciting and fixing the quality of mutability in her life forms. There is thus an element of mutability and reciprocation between the internal organism and its external surroundings. And the instability of the organism is a natural and a necessary part of the dual state of its existence. As Herbert Spencer has sententiously remarked in defining life itself, it is "a continuous adjustment of internal relations with external relations." Such, in brief, is the doctrine of variation, which is the starting point of Darwin's theory of the origin of species and the evolution of life.

Darwin at once seized hold of the enormous range of variation seen in domestic species, and its power of diversity and extension under the hand of the expert breeder and cultivator. And in utilising its multifarious phenomena in support of his thesis, he personally experimented with both animal and vegetable species. Here he showed that the key of man's power over species lies in the accumulation of his selections of varying and variable points of structure and character. Nature provides variations, and their succession in heredity. Man adds them up in directions useful to him. In this way he has built up great and serviceable breeds. He can not merely modify the character of his types, but he can change them altogether. It does not require a great effort of the imagination to determine the motives of man in his selection and improvements of breeds to serve his ends. It is known that sheep skins were used for tents, as well as for clothing and foot-wear, from the earliest nomadic times. Size would, therefore, be a desideratum. Warmth and comfort would be desired. Length and fineness of fleece would, therefore, be sought for. Purity of colour would be appreciated. White, and its pure and uniform tints, would be desired. Principles of economy would dictate considerations as to weight, strength, and healthiness of skin and so forth.

THE FIRST EXPERIMENT.

Early in the history of the world it can be well imagined that wealth was measured by sheep. And the dignity of shepherding and the peace of pastoral pursuits bulk largely in ancient literature. The flocks of Abraham and Lot, as the measure of their prosperity, are said to have been more than the land could support. They were the chief resources as well as the spoils of the whole history and the wars of the Israelites. Solomon dedicated 120,000 sheep to the purposes of religion and the temple. Pliny remarks that sheep were used as sacrifices to the gods, as well as for food and clothing. The enormous superfluity of the flocks of ancient times must have been the product of careful selection; and it will be remembered that the first successful experiment for the production of a new colour was made by Jacob, as recorded in the Scriptures. He peeled rods of poplar, hazel and chestnut, so as to give them a "ring-streaked" or dark and white appearance. These he placed in the water troughs of the flocks. In this he supposed according to the world-old tradition that the speckled appearance would be reproduced in the young lambs through the impressionable character of the ewes carrying young. White troughs have since been used, and even white cloths have been hung up in the fields for the same purpose.

WILD AND DOMESTIC ANIMALS.

The original stock of domestic sheep is represented by, and more or less obscurely traceable to, less than a dozen wild species. These vary in outward appearance and character, considerably from the goat-like, furry rather than fleecy, blue sheep of Tibet, to the Moufflon or Armenian wild sheep of Europe. The latter is said to be the original progenitor of our domestic varieties. They formerly existed in the islands of Sardinia and Corsica in large numbers, and were the object of large organized hunts, as many as 500 being shot in a single drive. To-day they are not so numerous, and the captured are much less. Their affinity with domestic sheep is seen in the fact that now and then the wild Moufflon will forsake the wilds and mix with the homestead sheep, while it is also known that orphan lambs of the homestead have found a dam amongst the wild species. The variability of the domestic sheep of the world is more marked. The Africander fat-tailed sheep carries a tail which is frequently found to weigh 50 pounds, trails on the ground, and is supported by the breeder with a contrivance on little wheels. It is regarded as a delicacy, and is an important item in the mutton. On the other hand, there is a breed of sheep in Central Asia with a mere rudimentary tail, the fat natural to this part having accumulated on each side of the haunches in large protuberances as if like the camel's hump they were nature's store against future famine, which man takes advantage of and breeds out. Darwin notices the Angola variety of the long-tailed race which has similarly curious growths of humpy fat in the region of the head. The multiplicity of varieties of the sheep and their extremes of peculiarity render the veriest reference to specially interesting features out of the question in these notes. There are in the museums of the world collections of mediaeval, modern, and wild stocks, and in some of the European zoological collections a few living specimens. In the museums may also be seen fossilized remains which carry us back to the very early geological times in the earth's history. Although the ancestry of the horse may be definitely traced to the most ancient primeval epochs, that of the sheep still remains in obscurity. But it is known that this important domestic animal appeared wild in the tertiary epoch in company with the horse, camel, ox, hog and elephant. This takes us back to about 2,500,000 years ago. And according to authorities on the subject, there is ample evidence that in the quartermary epoch of the earth's geological age man had acquired some of the arts of agriculture. He had domesticated the docile sheep, and afterwards the ox, the cat, the dog, and the fowl. He had learned to dress hides, and had accomplished primitive methods of weaving. And this period is fixed as variously approximating 500,000 years ago.

BEQUEST TO O.F.N.C.

The Ottawa Field-Naturalists' Club is pleased to acknowledge a bequest of $100 by the will of the late John Charles Kearns. The late Mr. Kearns was a member of the Club for many years, and always took a very keen interest in its work.

The Council, at a recent meeting, decided to set this bequest aside as an endowment fund, the interest from which could be offered as an annual prize bearing the name of the donor.

G. LeL.

SOME HABITS OF SWAINSON'S HAWK IN MANITOBA.

By Norman Criddle, Treesbank, Man.

Swainson's Hawk (*Buteo Swainsoni*), is essentially a bird of open woodlands or hilly country. It prefers a mixture of the two for nesting purposes, and the open gopher-infested plains for a hunting ground. Reaching us rather later in the spring than most of our other hawks, it almost immedietaly sets about selecting a nesting site, the place chosen being usually either a scrub oak or an isolated aspen poplar. Occasionally, however, the birds abandon their usual practice and select a hill instead of a tree for nesting purposes, even when trees are available. On the plains farther west they do not have so much choice in the matter, and in consequence they are obliged, if they nest at all in such places, to be contented with a hill or river bank.

As I have previously pointed out, on several occasions, there are few more useful hawks, in our Canadian west, than this species. Years ago, in his "Birds of Manitoba," Thompson Seton suggested the name gopher hawk for this bird, and I know of no more fitting title. This does not suggest, however, that these birds live only on such animals. Those of us who know them well are aware that they are by no means partial in this choice. Young grouse, meadowlarks and other birds certainly form a portion of their diet, as do also, occasionally, young poultry. But observation also teaches us that at least 80 per cent of the food is made up of noxious rodents, and that is surely an excellent showing, well entitling the bird to protection.

In former times these handsome dashing hawks frequented the plains in considerable numbers, seeking and obtaining an easy living among the gopher population. As time went on, however, the persecution they were subjected to by farmers and others greatly thinned their ranks, so that to-day they are restricted to a few isolated or unsettled districts, where they are permitted to rear their young in comparative safety. I am pleased to say that one such district occurs in the neighbourhood of my home, it being situated on one of the Dominion timber reserves. It is there that I have been privileged to watch the birds for a number of years past, and have gleaned some interesting information relating to their habits and life history. Some of this information I have already related in a previous volume of THE OTTAWA NATURALIST. I shall here, therefore, chiefly confine myself to some observations made last summer, while I was out on some of my usual Sunday afternoon rambles.

My first excursion into the "Sand Hills," where the hawks reside, was in early June, when in company with two of my brothers, I was fortunate enough to run across three nests. The first of these, which I shall call No. 1, was situated in a dwarf oak (*Quercus macrocarpa*), the tree being some 14 feet in height, and the nest about 8 feet from the ground in its bushy limbs. In the nest were five eggs of the usual blotched type, and sitting upon them was a bird which was very loath to leave. It, however, rose on our close approach and rapidly soared skywards. When well out of reach it was joined by a companion and uttered shrill shrieks of defiance. The second nest was located about three miles from the first, and some five miles from home. This, unlike the first, was situated upon the point of a hill which rose some 20 feet above the surrounding level. This hill, however, was by no means isolated, there being numerous others round about, some of them actually higher, its only advantage in comparison being that it reached more of a point at one end where the nest was placed. The nest itself was of a decidedly bulky nature, being built of large sticks, with smaller ones and some bark as a lining. In this were seven eggs, the greatest number I have ever observed in one nest, the usual number being four, and not infrequently one finds only three. The third nest, like No. 1, was situated in a dwarf oak growing this time at the bottom of a hill. It contained no eggs, though a few green leafy boughs in it showed that its builders had recently been at work. This nest was about two and a half miles from No. 2, and on account of its distance from home was not again visited.

On June 27th I visited the first two nests for the second time. No. 1 now had some downy young in it, two striped gophers (*Cetellus tridecemlineata*) and one gray gopher (*C. Richardsonii*). No. 2 harboured five young and one egg, the young being half grown, though of different ages as usual. They were curious fluffy fellows, having a mixture of down and feathers, the latter being chiefly confined to the wings. They all opened their beaks as I approached, and the largest, as if guardian over the rest, did his best to defend them and frighten me away. In this nest half a gray gopher was the only available food.

On July 4th I was again in the vicinity, and found No. 1 nest with the young still present, and that their hunger had been recently appeased was evident from the presence of two untouched striped gophers in the nest. In nest No. 2 the young were still unable to fly, though three had made their way some distance along the hill. I returned these for the sake of a photograph, and they made very little effort to prevent my handling them. Curiously enough, there was still but one of a pugnacious nature, and he, as previously, seemed to consider himself in charge of the remainder, and in that capacity resented in a ferocious manner my handling of the rest. One of the parents also made a half-hearted effort to frighten me by diving towards me. It took good care, however, to remain well out of reach. In the nest at the time were two gray gophers, one of them partly eaten, showing in spite of five almost fully grown young that the parents were able to keep the larder well supplied. I would like to draw attention here to the habit these birds have of going far afield for their hunting. In the case of nest No. 2 the nearest gray gopher colony was fully two miles away, while to secure them in numbers entailed a journey of four or five miles, and there is reason to believe that the hawks went even further than this. That they usually flew directly to their hunting grounds was also evident from the fact that in no instance were striped gophers found in the nest, though those rodents were met with more than once in its vicinity. While the hawks keep the nest and its immediate surroundings free from refuse, I was, nevertheless, able to secure a few pellets, which, as is well known, all birds of this kind disgorge. An examination of these revealed much gopher hair, a few feet of those animals, and two feet of a meadowlark, both in the same pellet, showing that they doubtless belonged to one bird.

As I left the nest its defender still stood erect on its edge watching my every movement, like a sentry on duty, and thus he remained until distance hid him from my sight.

On July 5th, a parent hawk which was flying very high, suddenly made one of those dives for which the birds are remarkable. In a moment it was among a brood of young turkeys, and but for their remarkable instinct in hiding, and my presence soon after, would have undoubtedly carried off one of them. As it was, the hawk continued on its journey southward to the usual hunting grounds.

On July 17th I visited nest No. 1 for the last time. I found it inhabited by four almost fully-fledged young. I had, in fact, just taken a photograph, and was searching for pellets beneath the nest, when the strongest bird flew out, but finding its weight still too great for its wings, it came to earth rather suddenly some 40 yards away, not, however, with sufficient force to be injured, as was indicated by the vicious manner in which it met me as I approached. Its onslaught was most determined, and I was obliged to defend myself with a spade, which the hawk struck repeatedly with its claws, but never with the beak. When exhausted with its efforts at jumping, it threw itself upon its back and struck out with both feet. Having finished my observations I retired, the hawk actually making after me, evidently considering that I was being driven from the field. The other birds remained in the nest in company with two striped gophers, one being partly devoured. Pellets around the tree showed much gopher hair and some broken bones, but no indication of birds. It seems strange that this pair of hawks fed their young mostly upon striped gophers, while those of No. 2 preferred gray ones; doubtless situation had something to do with this, though both kinds of gophers were within reach. Another nest I had not previously visited was located in an aspen poplar, in an opening among the lower trees. There was a single hawk in the nest which immediately flew on my approach and disappeared in the distance. In this case the parent birds, as is customary, had been shrieking overhead while I was yet more than a mile away, and had even attacked me in the usual timid manner. As a matter of fact it was their own stupidity that led me to the nest, which but for their efforts I should never have found. Pellets in this instance were absent, consequently I could learn nothing of the birds' food habits.

To those unacquainted with the fauna of Manitoba the question might arise, how do these hawks manage to defend themselves while nesting on the ground, particularly upon a hill which is so frequently used as a vantage spot by coyotes. Is it that hawks make but poor eating, or do the coyotes, badgers, etc., fear those formidable claws? I do not know, but suspect the latter is more probably correct.

It is a very great pity that lack of knowledge regarding the usefulness of these hawks has caused them to be so severely persecuted. We are all of us aware in the west what a large toll gophers take of our crops, yet strange to relate, we seem to have done our best to propagate them by destroying the hawks and weasels, which are their natural enemies.

FIFTY-SECOND ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

This meeting will long be remembered by those present as an extremely successful gathering, at which members convened from both ends of the Dominion, to meet their fellow workers at the Capital. The meetings of this Society have long been known for their successful programmes, but if we are to believe those competent to judge, the gatherings on the 4th and 5th of November last excelled in this respect any previous conventions, and in point of value to agriculture, were to Canada equally as profitable as the meetings of the Association of Economic Entomologists are to the United States.

The meeting was held in the large laboratory of the Entomological Branch, Department of Agriculture, Ottawa, thus not only providing ample accommodation, but also enabling visitors to inspect the large collections of insects housed there. While the Society had to deplore the unavoidable absence of Dr. Howard, Chief of the United States Bureau of Entomology, who was to have delivered the popular lecture, we were fortunate in securing instead another distinguished American in the person of Dr. H. T. Fernald, of Amherst, Mass., who delivered, on Thursday evening, November 4th, a most interesting and instructive lecture, the title of which was "Life Zones in Entomology in relation to Crops."

It is unnecessary to mention the names of all those present; sufficient to relate that the meetings were very largely attended. There were, however, a few visitors who cannot well be passed over, namely: Prof. C. P. Lounsbury, Chief of the Division of Entomology, Department of Agriculture, Pretoria, Union of South Africa; Mr. A. F. Burgess, who has charge of the United States gipsy and brown-tail moth work, and Dr. Hugh Glasgow, of Geneva, N.Y. In addition to many prominent members of the Society, there were in attendance all the scientific staff of the Dominion Entomological service, as well as the following well known Canadian visitors: Sir James Grant, Dr. F. S. Torrance, Veterinary-Director General; Dr. F. T. Shutt, Dominion Chemist; Mr. W. T. Macoun, Dominion Horticulturist; Dr. C. H. Higgins, Pathologist, Dominion Department of Agriculture; Mr. H. T. Gusrow, Dominion Botanist; Mr. R. H. Campbell, Director of Forestry; Mr. W. Ide, private secretary to the Minister of Agriculture; and Mr. D. Johnson, Dominion Fruit Commissioner.

The papers read, while usually of a scientific nature, and therefore of interest to a limited audience, provided, nevertheless, some noteworthy exceptions, which must have appealed to any lover of wild life. In this connection we would mention the paper of the Rev. Dr. Fyles, of Ottawa, on "Observations upon some of the Predaceous and Parasitic Hymenoptera;"; "The Home of Gortyna stramentosa," by Mr. A. F. Winn, of Montreal; "The Founding of the Science of Cecidology," by Dr. A. Cosens, of Toronto; and "Fresh Woods and Pastures New," by Mr. F. J. A. Morris, of Peterboro, Ont.

Of truly scientific papers, of which there were many notable contributions, we will mention but one: Dr. Seymore Hadwin's, of Agassiz, B.C., "Further Notes on the Warble Fly (*Hypoderma bovis*)," a valuable contribution, in which the writer produces conclusive evidence as to how the larvæ enter the bodies of cattle, the method being quite at variance with ideas previously held. All the papers presented at the meetings will ultimately appear in the Annual Report of the Society, and should be in the hands of all interested in either agriculture or entomology.

The meetings were presided over by the President, Dr. C. Gordon Hewitt, until the last afternoon, when setting a new and appropriate precedent he vacated the chair in favour of the newly elected president, Mr. A. F. Winn. The other officers elected were: Vice-President, Prof. L. Cæsar, Guelph; Secretary-Treasurer, Mr. A. W. Baker, Agricultural College, Guelph; Curator, Mr. G. J. Spencer, O. A. College, Guelph; Librarian, Rev. Prof. C. J. S. Bethune, Guelph. Directors: Division No. 1, Mr. Arthur Gibson, Ottawa; No. 2, Mr. C. E. Grant, Orillia; No. 3, Dr. A. Cosens, Toronto; No. 4, Mr. C. W. Nash, East Toronto; No. 5, Mr. F. J. A. Morris, Peterboro; No. 6, Mr. J. W. Noble, London, and No. 7, Mr. W. A. Ross, Vineland Station.

On Friday evening, November 5th, a smoker was held in honour of the Society, the hosts being the entomological section of the Ottawa Field-Naturalists' Club, the president, Mr. Arthur Gibson, welcoming the members in a short speech. The proceedings that followed were presided over by Dr. Hewitt, and were greatly enjoyed. They ended, as was to be expected, in the height of good fellowship.

N. C.

THE CANADIAN FISHERIES MUSEUM.

Members of the Ottawa Field-Naturalists' Club will be interested to learn that the above-mentioned museum has been recently entirely remodelled by Mr. Andrew Halkett, the well known naturalist of the Dominion Fisheries. The object of this museum is to display in an educational manner all forms of aquatic life, and chiefly to illustrate the value of our vast fishery resources. The fishes proper, which for the most part are mounted specimens of the fishes themselves, are beautifully arranged and classified, according to Mr. Halkett's recently published "Check-List of the Fishes of the Dominion of Canada and Newfoundland," in cases around the walls on the ground floor of the museum. In view of much additional material, most of which has been recently acquired and mounted, the large room up stairs, formerly used as an Art Gallery, will in the near future be devoted for the display of this material, and will, therefore, soon be open to the general public. A conspicuous object which will be on view in this room will be a mounted skeleton of a Fin-back Whale, 51½ feet long, from the Seven Islands Whaling Station, Gulf of St. Lawrence.

Whilst the direct object of the Fisheries Museum is to point out the value of the Canadian fishery resources, yet incidental to the collection there are also on view a variety of natural objects, embracing fishes, corals, sponges, mollusk shells, etc., from the Bahama Islands, and such form an ornamental feature of the museum.

Models of vessels, weirs, traps, etc., to illustrate the fishing industry, are also on exhibition.

Recently two specimens of octopus or devil fish have been installed, and are to be seen in glass cases, preserved in a solution of formalin. These specimens are from the coast of British Columbia.

OTTAWA FIELD NATURALISTS' CLUB.

PROGRAMME OF WINTER LECTURES.

December 7th, 1915 (Tuesday).—"Wheat Improvement in Canada." Dr. Charles E. Saunders, Dominion Cerealist, Ottawa.

January 11th, 1916 (Tuesday).—"Canadian Folk-tales and Oral Traditions." Mr. C. M. Barbeau, Division of Anthropology, Geological Survey, Ottawa.

January 25th, 1916 (Tuesday).—"The Use of Ornamental Trees and Shrubs." (Illustrated with lantern views). Mr. W. T. Macoun, Dominion Horticulturist, Ottawa.

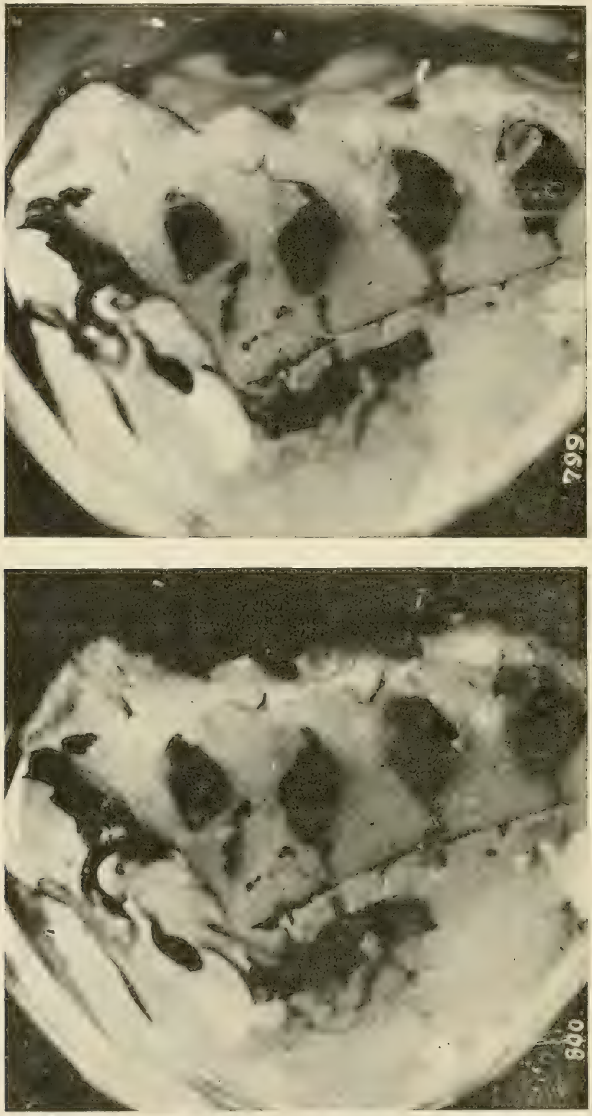
February 8th, 1916 (Tuesday).—"The Formation of the Great Plains." (Illustrated with lantern views.) Mr. D. B. Dowling, Geological Survey, Ottawa.

February 22nd, 1916 (Tuesday).—"The Evolution of Army Sanitation." R. Lorme Gardner, M.D.

March 7th, 1916 (Tuesday).—"The Identification and Nesting Habits of Some of our Common Birds." (Illustrated with specimens and lantern views.) Mr. W. E. Saunders, London, Ontario.

March 21st, 1916 (Tuesday).—Annual Meeting, Exhibits and Brief Addresses by Members.

All the above meetings will be held in the auditorium of the Victoria Memorial Museum.



Benthopecten simplex Perrier, inner portion of arm viewed from the side (marginal removed) x 20 dia. mounted under gum. West Indies 1323 fathoms. Specimen from Museum of Comparative Zoology, Cambridge, Mass. To be viewed through a stereoscope.

THE OTTAWA NATURALIST

VOL. XXIX. DECEMBER, 1915 No. 9

THE USE OF GUM DAMAR IN PALEOHISTOLOGY.

(With Notes on the Genus Benthopecten.)

By George H. Hudson, Plattsburgh, N.Y.

In the study of the detail of opaque objects with the simple or compound microscope, there are some very decided advantages to be obtained through covering the object with some transparent medium that may be used to hold a cover glass in position. The writer has long used a solution of gum damar in benzol for this purpose, and whether the mounting was for temporary observation, for drawing under camera lucida or for photomicrographic work, the results were often of surprising value. For instance, he was enabled by this method to obtain a microphotograph which without retouching was used for the production of a figure (1911, plate VI, fig. 1) showing clearly the sutures surrounding the radianal of *Palaeocrinus striatus*, Bill. Billings stated that he could not make out the sutures in this region, and so left it blank in his published analysis. Bather, in Lancaster's "A Treatise on Zoology," Part III, p. 172, gives an analysis that for this region is in error. How great a help this process is in revealing sutures may also be seen by comparing (1911) figures 27 and 28 on page 252. The writer will here give reasons for the character of the results obtained, present other advantages of the method, and give briefly a description of the process as he uses it.

Suppose that we make the attempt to photograph a printed page through a sheet of ground glass placed directly over it. Much of the incident light will be reflected and scattered. Such of these rays as enter the lens will tend to produce a uniform fog over the whole negative. They are from the ground glass surface and not from the covered paper. That portion of the light which reaches the printed surface cannot return without being subjected to both reflection and refraction on account of the many minute angles presented by the ground surface through which it must pass. This tends to give us numerous overlapping images. If now we will wet, oil or varnish the ground surface we shall cut down its reflecting power to a marked degree. The more nearly alike the indices of refraction of the two transparent media the greater will be the amount of light received by the lens from the covered object, and the sharper will be the negative secured.

In the making of photomicrographs of recent or fossil specimens we have to face conditions very similar to those just described. The innumerable elevated microscopic grains on an ordinarily rough surface catch light on their summits and scatter it as do motes in a sunbeam. This light caught on a photographic plate swamps the detail which lies just under these summits. If our specimen is of calcite a thin outer layer is practically transparent, and with the light scattering reduced, we should get some structural detail just under the surface itself. In this way we secured a view of the sutural canals of *Palaeocrinus striatus*, Bill., and their membranous linings in (1911), plate V, fig. 2, while only the canal coverings were visible where the gum was not used, as in fig. 1 of same plate. Compare also figs. 3 and 4 of this plate. In 1913 (*a*) plates 6 and 7, we illustrated the difference in effect secured when this process was used on very recent material. In same reference, in plates 3 and 4, we also showed the value of being able to penetrate thin sheets of calcite adhering to the surface of a mold. Its value in revealing features just underneath the surface was also shown in 1913 (*a*) plate 10. Sometimes we desire just the surface contours or topography,and we may then add to the reflecting points by using the Williams process (holding the specimen in the combining vapors of ammonia and hydrochloric acid). We may thus avoid all stains or detail in colour and get pure form. If, however, we are to do something more than simple species-making, we should desire the detail due to difference in tone or hue. For instance, in the author's work on Blastoidocrinus and Paleocrinus (1911), he found internal organs outlined with black and partially filled, by respiratory and alimentary processes, with mud now yellow with limonite. The contrast between ossicle and decayed soft tissue could have been reproduced almost as pure white and black, or very like the results obtained in 1913 (*a*), plates 7 and 8.

The better to compare these two methods we may suppose that a dweller on the moon desires to photograph the earth. If he could but find the illuminated hemisphere covered with cloud he could eliminate surface stain and get pure but very general form. On the other hand, could he find a hemisphere free from cloud he could get general form plus many differences due to hue and tone. He would have the deeper, truer surface, the detail of mountain and valley, and a very significant difference between sea, mountain top, Sahara and valley of the Amazon.

The ability by means of this process to reduce the amount of reflection from the microscopic facets of granular surfaces also allows one to quickly view detail on a surface one is grinding down in order to reveal internal structure.

The paleobotanist is well aware that soft parts may be preserved in fossil forms, for he not only recognises different tissues but sometimes individual cells. For him there is a true paleohistology. The paleozoologist, on the other hand, has hitherto been skeptical as to preservation of soft parts in fossil forms. The marvellous finds of Wolcott, his beautifully preserved annelida and delicate medusa-like holthurians—his reproductions of inner organs and discovery of fossil crustacean livers which still show their characteristic microscopic structure on cross section—these things now compel the paleozoologist to also become a believer. Traces of such soft parts should then be looked for, and the gum mounting is peculiarly adapted to reveal them. By this process the author has been enabled (1913 (*b*) plate IX, fig. 1) to show the remains of muscle fibres still adhering to a well-defined muscle field lying between the right hand fifth and sixth marginals of an arm of *Protopaloeaster narrawayi*.

METHOD.

Portions of the crude gum are selected for their clearness and lack of colour, and dissolved in benzol, to form a liquid that will filter easily. The stock solution should be kept in a glass-stoppered bottle, and a very fine bit of wire, or an insect pin, kept between the stopper and neck of bottle. Portions for use should be allowed to evaporate to such a consistency that the fluid will slowly drop from a glass rod. A regular dropping bottle will be found to be a convenient receptacle for the thicker gum.

The specimen to be treated may be attached to a glass slide by means of a few pellets of beeswax. Care should be taken to have the specimen so oriented that when placed on the stage of the microscope it will receive light at the angle which will best emphasize the features to be observed.

A cover glass of appropriate size and shape is then selected and cleaned, the specimen freed from dust, and a drop of benzol placed on it to free the pores or crevices from air. A few drops of gum solution are now added, and a drop also placed on the cover glass, which is then inverted and placed on the specimen. Additional gum may be easily run under the cover glass, and if bubbles are present a slightly inclined position will allow them to pass to one side and escape. Twenty-four hours or more is usually required to so fix the cover glass that it will not creep when placed on a vertical stage.

In case the specimen has a small or convex surface, the cover glass is first placed on a smaller support, such as the screw cap of a small vial, and the specimen attached to a slide is inverted over it. This slide is supported by a block or bunch of slides at one end, and a weight placed upon it to hold it in position. After making the proper adjustments the slide is removed, specimen and cover glass treated as before, and the specimen then returned to its inverted position. Gum may now be added from time to time until the gummed area is sufficiently large.

Porous specimens, such as colonies of bryozoa, are best treated by slowly lowering them into a very small volume of the thinner gum solution, thus driving out most of the air.

If it is desired subsequently to shift the position or angle of the cover glass, it is only necessary to add a little fresh gum at the edges and slowly push the cover to the new position. Deep Petrie or covered cylindrical glass dishes will be found useful in housing the mounted specimens and keeping them from dust.

To clean: place in benzol until the gum is dissolved. Rinse with a little clear benzol and let dry. The benzol used for dissolving and rinsing may be saved for subsequent operations.

The plate accompanying this article is introduced to show the value of the process where penetration of recent organic material is desired. The remains of muscle fibers here shown are, in appearance, practically as they appear in many fossil forms, when revealed by the gum process. Note that the first (upper) ambulacral (jaw piece) is supported by a process arising from the second. The oral end of each ambulacral is firmly attached to the adambulacral in advance of it. Between the lowest adambulacral in the figure and the ambulacral at the left of it, there is a dark spot revealing a bit of the buried ambulacro-adambulacral muscle. A contraction of this muscle served to draw the following ambulacral orad. The aborad wings on the oral ends of the ambulacra are so shaped as to allow this motion. While the ambulacra themselves are not truly imbricated, the pairs (adambulacral and following ambulacral) are distinctly so placed. The numbers on the lower edge of stereogram are those of the original negatives.

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1911.—Hudson, G. H. Studies of some early Siluric Pelmatozoa. New York State Museum, Bulletin 149.

1913 (*a*).—Hudson, G. H. The use of the Stereogram in Paleobiology. New York State Museum, Bulletin 164.

1913 (*b*).—Hudson, G. H. Does the type of Protopalaeaster narrawayi present an Oral or Aboral Aspect? The OTTAWA NATURALIST, Vol. XXVII (Oct. 1913) plates VIII-IX.

"GLEANINGS IN FERNLAND."

BY FRANK MORRIS, PETERBOROUGH COLLEGIATE.

Readers of the OTTAWA NATURALIST in 1910 who went "Fern-hunting in Ontario" with me, may remember that our treasure-trove amounted to 37 species. In the course of our wanderings, as I seem to remember, we had good store of pleasure, and surprises not a few; the charm of surroundings possessed by the ferns forming a spell of peculiar potency, our sheaf of fronds, in the getting and the gathering, gave us communion with Nature in some of her most enchanting haunts; while in tedding and garnering, these peaceful trophies of ours were still redolent of the woods, and even to-day keep green and fragrant with glad memories of summer days and rambles.

Manifold sights, unseen or unheeded before, taught us to keep eyes open and wits a-stretch for all the observations and reflections we could make. Some of the inferences that we drew might perhaps provoke inquiry; some of our questions never found an answer: moot points, one or two of which have since cleared themselves up; but nothing had happened till quite lately to justify rushing into print. Since last July, however, it has been my good fortune to add no less than six species to our list, and I believe it would be possible for a careful fern-hunter to extend the record to a grand total of 50, without stepping over the border of old Ontario. All, then, who love these most beautiful forms of living foliage, especially in their native haunts of woodland dell and rocky height, are now invited to "follow the gleam" once more, and dream themselves back into summer this Christmas-tide.

One of my first trips for ferns in the neighbourhood of Peterborough was two or three miles south east into Otonabee, my objective being Burnham's wood. The net result of two days' roaming was 15 species of fern: the Oak and the Bracken, the Silvery Spleenwort and the Lady Fern, the Christmas and the Marsh, the Marginal, Crested and Prickly Shield Ferns, the two Bladder Ferns, the two Onocleas, the Adder's Tongue, and the Virginia Grape Fern. A series of tramps west of the city added 10 more to my local check-list of the fern-flora, viz.: Maidenhair, Narrow-leaved Spleenwort and Goldie's Shield Fern, the New York and the Hay-scented, the three Osmundas, and two more Grape-ferns—the Little and the Ternate. This June, in the intervals of a day's trout fishing south of Bethany, I found another station for the Narrow-leaved Spleenwort and its "*fides Achates*," the Goldie's, besides having the exquisite pleasure of discovering five or six fine clumps (in full bloom) of the Macrae's or Striped Coral Root orchid.

Just before the month ended I paid a flying visit to my old home, 30 miles south of Peterborough. In the few days available I had to choose which of my ancient cronies to gladden my eyes with, and after a tramp north to the ridges, known locally as the "Rocky Mountains," I determined on one long day near Newtonville, in the tamarack swamp with its surrounding fringe of cedars, where ten years ago I made my first rare find among ferns. In order to give some spice of variety to the coming banquet, I chose the new C.P.R. route, which landed me further west by two miles than I had ever been before. Tramping steadily north for a mile, I found myself in full view of the village, and with a very inviting swamp to the east. Shaking the dust of the road from my feet, I swung myself over to the happier side of the fence, and crossing a couple of pastures soon gained the edge of the swamp; distance often lends enchantment, no doubt, but, fortunately, nearness by no means always brings disillusionment; the stretch of swamp had looked promising even from the road, and when I got a nearer view of it, I felt sure the promise spelled fulfilment. Do you know the delightful sense on a field day of being on the verge of mystery, the edge of some discovery, a sense of expectancy like a hush, that sometimes in the shadow of the woods deepens into awe? That feeling came over me now, and I paused a few moments for it to thrill me through, before advancing into the unknown.

All the details of a long eventful morning are fresh in my memory as I write, but space and time forbid more than a summary. I found, in my very incomplete survey of the swamp, hundreds of plants of the Adder's Tongue, and besides the Virginia and Ternate Grape-ferns, I discovered some six stations for the Little Grape-fern and the Matricary; and also (to my huge delight) two colonies of the Narrow-leaved Beech Fern. In the autumn I found another station for this last, north of Colborne, but except for these two finds, I have never seen the plant so near Lake Ontario. In the afternoon I hurried on to the tamarack swamp, intending to make a round of calls and hob-nob an hour or so, but while in the heart of a huckleberry marsh, gathering a posy of *Arethusa* and *Pogonia*, I was overtaken by drenching rain, which threw a wet blanket on all my plans. To get out of the swamp I had to wade over 100 yards through shrubbery almost waist high, and by the time I gained a corduroy road, flanked with Royal Osmunda, and serving (among other things) to cleave in two a most wonderful colony of *Botrychium simplex*—thousands of plants—I was like a drowned rat. Had it been fine, my plan was to go north to the C.N.R. station of Starkville, for this would have brought me past at least two of my favorite haunts in Fernland: a roadside colony of the Hay-scented Fern, and a series of grassy slopes and low knolls in a willow swamp, on which in the short turf are scores of enormous plants of *Botrychium ramosum* (Matricary Grape-fern). But it was not to be, and this, one of the earliest of my all-day fern-hunts, proved curiously typical of the whole season: a promise of sunshine that ended in rain.

In the first week of July I had to report for duty in Toronto, and mark matriculation papers in the arid waste of a Varsity lecture room, while ever and anon the wizard's wand of imagination transformed the bare space into a leafy grove with ferns and orchids unfurling their crosiers and gay bannerets about my desk. On July 25th, a drudge no more, I hurried down to the Yonge Street wharf, and got the fresh lake breeze from the upper deck of a Niagara boat to blow the dust and grime of city haunts away, clear my head of cobwebs, and sweeten my heart for the reception once more of the fair works of nature.

From headquarters at Queenston village next day, before 5 a.m., I went up to the Heights on foot, and then along the electric railway track towards Niagara Glen. This meant 16 hours—an all-day revel—among woods and thickets near the stupendous gorge, or down in the moist, shady glen, within sight and sound of the rushing cataract. It was a glorious day, and on the New Jersey Tea blossoms by my path I found, among scores of insect visitors, several strange beetles of the *Leptura* and *Strangalia* genera, besides many little chrysomelians busy at their various food plants. The Glen itself is famous for its flora, and I wandered for hours among the giant growth of Goldie's Shield-fern and Narrow-leaved Spleenwort, past huge boulders wreathed with Walking-leaf and crowned with Polypody, or under cliffs studded with the Purple Cliff-brake and Black Spleenwort. Soon after twelve o'clock I left the last fountain and followed the footpath upstream as far as it went; then I made my way on over loose stones and tangled undergrowth to a grove of hemlock and cedar, where I sat down in silent communion with my favorite denizen of this silvan retreat: a tiny colony of the Ebony Spleenwort. This beautiful fern is far from common, the only other colony of my acquaintance being on the north shore of the Upper Rideau, nearly opposite Sand Island.

It was far on in the afternoon when at last I climbed reluctantly out of this fern paradise by the steep flight of wooden stairs. Having absorbed all the beauties of the wayside on my morning's tramp, I had myself flashed back to Brock's Monument in the electric trolley car, and thus stole a march of over an hour on fleet-foot Time.

From the Monument I walked along a wooded lane on the edge of the Heights till I reached a fine rich open wood, characteristic of the peninsula in the number of chestnut trees among its larger timber,—not *Aesculus*, the Horse Chestnut, but *Castanea*, what in England we term the Spanish Chestnut—characteristic, too, in its rich clumps of Beard Tongue and Oak-leaved Gerardia, both blooming luxuriantly at this latter end of July. The wood was much dryer than our woods further east, and quite open—compact of sunny glades rather than shady groves. Here, to my great delight, I found five or six colonies of a fern till then new to me, the Broad-leaved Beech fern. The living frond is quite distinct in appearance, especially when still young, from that of the Narrow-leaved; exactly where the difference lies is a little difficult to say; sometimes the two are in shape and proportions identical, but as a rule in the Broad-leaved species, the frond is light yellow-green, and smoother, less hirsute. In writing of it five years ago, I was in error when I said it was common near Owen Sound. The Narrow-leaved species is common near Barrie, but the true home of the Broad-leaved is further south, and in south-western Ontario, Welland, Niagara and other districts, it seems to take the place of the Narrow-leaved form. It is recorded from woods near Campbellford, and evidently prefers limestone. In the Algonquin Park, where Huronian and Laurentian granite abound, the Narrow-leaved Beech-fern luxuriates in every moist woodland hollow, and even subsists in dwarfed form on bare crags and the sides of railway cuttings.

The close of July found me established in lodgings at Owen Sound, with a fern press and piles of blotting paper. I had long wanted to visit this famous fern-centre, but till now had never realized my wishes. It is a beautiful neighbourhood, and (to a fern lover) unique in the Province for some of its plants. The city lies in a great hollow delta, flanked on either side by high limestone cliffs that start from Sydenham Falls, a few miles back of the town, and rapidly diverge in the direction of the Sound. The ferns are almost entirely those peculiar to limestone, but within these limitations it is one of the richest localities in North America.

I got there at 1 p.m., and as soon as I had found my quarters and lunched, I hurried out to explore. Making my way west to the nearest flank of limestone, I followed a steep road to the top of the cliff, and looked about. South of me ran another diverging cliff, with signs of an active lime and cement quarry not far off. Making a slight detour round this to a more sequestered part of the cliff, I got my first surprise. In a stony, half-wooded pasture near the cliff, where limestone strata cropped out of the grass, were several large plants of the Holly Fern! And some of them actually showing signs of having been chewed by that omnivorous ruminant, the domestic cow. You may well imagine what a rude disillusionment and shock it was to me, when I tell you that the only other time I had seen this fern was 3,000 feet up the steep side of lone Ben Lui, in the Perthshire Grampians. It is abundant in the Rockies, and all through this limestone district, from Collingwood west to Tobermory, at the head of the Bruce Peninsula, it fairly runs riot. While slowly moving along at the foot of the cliff, I found in the course of a few hundred yards, plants of Purple Cliff-brake, Slender Cliff-brake, Black Spleenwort, and finally, to grace the triumph, a fine colony of Green Spleenwort. This fern is almost identical with the Black, except that the stalk is brown at the base, and then green from the upper part of the stipe to the tip of the frond. It is abundant on mountain heights in Wales, North England and Scotland, and I have seen it once in Ontario, growing on deeply shaded limestone ledges by the Speed, near Rockwood. Later, I found it growing abundantly on detached limestone boulders in the woods below Sydenham Falls, near the opposite cliff that flanks the east of the city. By this time it was late in the afternoon, and I returned to headquarters.

Next day I went out to Sydenham Falls, and rambled in the wood below, with its rich, swampy hollows filled with Narrow-leaved and Silvery Spleenworts, Goldie's Fern and Maidenhair, and found (along with more Holly Fern) the treasure for which the district is noted, the far-famed Hart's Tongue. This fern is very plentiful in the west of England, and in parts of Somerset and Devon fairly chokes the wayside ditches and hedgerows. But on the American continent it is extremely rare, Woodstock in New Brunswick, Central New York and Tennessee providing the only known stations for it outside of Ontario. It belongs to the talus at the foot of limestone cliffs, or to moist shady situations in limestone districts; at one time it was apparently more generally distributed, and specimens are recorded from Niagara, as well as many widely divergent points of Bruce and Grey counties. Among the ferns of temperate regions, the Hart's Tongue is almost unique in form, the frond being simple and entire—like a long, narrow dock leaf—but the surface, like that of the Holly Fern, is smooth and glossy. Near the Sydenham Falls this rarity proved very abundant, both below the cataract and above, the crevices of the limestone floor throughout the extensive woods being filled with plants of this and the Holly Fern. The growth of the fronds below the falls was very luxuriant, sometimes from 24 to 30 inches. Before my stay ended I found many other stations for the Hart's Tongue, several miles west of Owen Sound, also on the Rocky Saugeen, near Durham and close to Wiarton. Had this ended my successes I should have been well satisfied. But a delightful surprise was still in store for me. Prof. Macoun's catalogue of 1890 mentions for many of the ferns the name of Mrs. Roy, of Roystone Park, Owen Sound. Among the late Mrs. Roy's recorded finds is the Male Fern, "at the foot of cliffs behind Roystone, and under the same line of cliffs some ten miles up the coast." Finding that Roystone Park was a farm, I called on the tenant, and was directed across hay fields, past the shooting butts, to the cliffs in question. Not five minutes' search—though the record is probably 30 years old—revealed the plant, its identity being all the less questionable because I had so often gathered its fronds in England, Wales and Scotland. But so rare is it in our part of Canada, that I had never seen it at all on this continent, and indeed there is no other station for it known in Ontario. Not only was it abundant at the back of Roystone, but two or three plants were found in sheltered crannies of talus on the adjoining lot. As soon as opportunity served, I made an expedition by buggy up the coast as far as Kemble, and back to the cliffs behind this village. Here the Male Fern was again discovered, both below the cliff and in the woods above, robust, luxuriant and plentiful, occasionally hybridising with its neighbour and congener, the Marginal Shield Fern. But how is one to account for such a limited range in the Province? Two stations about 10 miles apart, with a diameter, the one, of some 50 yards, the other, of perhaps half a mile, in the single county of Grey and nowhere else.

On August the 10th my wife and I had arranged to set up our usual summer tent on Cache Lake, in the Algonquin Park. Shortly before that date I made a trip from Owen Sound to Durham, in the hope of finding *Pellaea densa*, the extremely rare Cliff-brake discovered there by Dr. H. M. Ami some years ago. Unfortunately the date fixed for our trip proved the day of the great gale and rainstorm over Lake Ontario, and the west of the Province. It had already begun to rain when Durham was reached, and conditions grew rapidly worse for the rest of the stay. Bad weather and lack of time combined to make three proposed trips impossible, two from Owen Sound and the third from Utterson, on the way up to the Algonquin Park.

To be continued.

THE CURIOUS EGG OF THE HAGFISH (*MYXINE*).

BY PROFESSOR EDWARD E. PRINCE, DOMINION COMMISSIONER OF FISHERIES, OTTAWA.

In classifying fishes. scientific authorities have always placed lowest on the list the hagfishes and lampreys. Indeed, the well-known writer on fishes, William Swainson, in his excellent book, the "Classification of Fishes," London, 1838, goes so far as to claim, regarding the hagfish (*Myxine*), that "all authors agree in placing it near the worms." These fish are, of course, far removed from the worms; but with the exception of the Lancelet (*Branchiostoma* or *Amphioxus*), they are the lowest and most rudimentary of vertebrate animals. The late Dr. Theodore Gill and others concluded that they ought to be separated from the true fishes, and placed in a separate class, owing to their many rudimentary structural features. Thus, they have no paired fins, no scales, no segmented backbone, (the jelly-like notochord persists), no complete skull, no spleen, no pancreas, a very simple brain and nervous system, a peculiar series of gill-pockets instead of typical filamentous gills, and their whole form and structure are in contrast with the true fishes, and higher vertebrates generally. It is still a debated question whether or not, in this peculiar group, the features referred to are original and primitive or degraded and degenerate. In all, the mouth is round and adapted for sucking, not biting. The lamprey attacks fishes, adhering to the outside with its mouth, which it uses like a vacuum sucker, and removes flesh and blood with its rasp-like horny teeth. The hagfish bores its way into fishes, living or dead, and eats out the interior, leaving little more than the skin and bones of its victim. Fishermen find cod and haddock hanging to their hooks which have been destroyed in this way. Moreover, the hagfish has a remarkable device for protecting itself from enemies. The skin is provided with slime glands and pores, which enable it, at will, to pour out a great quantity of tenacious ropy slime, in which it envelops itself. I have seen a specimen, the size of a medium-size eel, fill a bucket with this gummy grey substance, exuded from the slime pores. There are not many species of hagfishes, and they are very local in their occurrence. Thus, *Myxine glutinosa* is well known to abound off St. Abb's Head on the Scottish coast, but is rather rare in other areas. Our Canadian hagfish so closely resembles the British form that both were included in the same species, though our western form is now known as *Myxine limosa*.

Many years ago, when I was the Naturalist at the Scottish Marine Station, St. Andrews, I paid special attention to *Myxine*, for the reason that no one had ever seen a male specimen, and very little was known about its eggs. One egg only was known to scientific men, so far as I am aware, viz., a single specimen in the Bergen Museum, Norway. No doubt it was the study of this unique and valuable specimen which enabled Professor Allen Thomson, of Glasgow, to describe and figure the hagfish's egg in his article "Ovum," in Todd and Bowman's Encyclopædia of Anatomy. I dissected many hundreds of specimens and found plenty of eggs, yellowish brown, very hard to the touch, and about the size of a small bean. Each egg was narrow at the two ends, as Professor Thomson had described, but I never found the bunch of hooks at both apices, which appeared in his description and figure. Carl Claus, in his "Zoology," says that "the deposited egg is recognisable by the filaments attached to both poles, and which probably serve to fix it to sea weeds," while Professor Arthur Thomson, of Aberdeen (Outlines of Zoology, 1892) states that "each has an oval horny case, with knobbed processes at each end. By these they become entangled together." In Dr. Lenn's "Synopsis der Thierkunde," Hanover, 1883, Bd. I., Professor Hubert Ludwig describes the "horny shell as provided at both ends with a long bunch of thread-like hooks." This bunch of threads or filaments is evidently pushed out after the eggs are deposited, for I saw no trace of them in the large number of eggs, many thousands, which I removed from ripe hagfish in Scotland. I may add that I found no males, and this was due to a fact, one of the most astonishing in the whole field of zoology, viz., that only the very small specimens are males, and, as they grow bigger, each changes its sex, and, later in life, produces not sperms but eggs. This sex-transformation, first discovered by Mr. J. T. Cunningham, and by the famous Dr. Nansen, is called "protandry."

It was with very great delight that I found in July last some of these exceedingly rare objects, the ripe eggs of *Myxine*, at the Biological Station, St. Andrews, N.B. Professor Philip Cox, of Fredericton, who was engaged in scientific researches at the station, had placed them in a sea-water tank, under a constant circulation of water, with the hope that they might hatch out. The larval hagfish has never been seen by any zoologist, and a description of it would be of the profoundest scientific interest. After several weeks the eggs died and began to show signs of decay, and before their condition was too advanced I made a study of their external features. In view of my work on *Myxine* in Scotland, I felt a special interest in examining the structure of these rare specimens. Like the Scottish examples, they were over half an inch in length, oval in shape, and of a whitish yellow colour. The colour is due to the creamy yoke inside the horny shell, for the shell is very transparent, and somewhat thickened at the apices. Each end or apex of the egg rose into a protruding mound, from which projected forty or fifty slender threads, about a fifth of an inch long. At its root each thread was enlarged and outspread, but diminished distally and became slender, until near the free tip, it enlarged again and expanded in the flattened form of a hooked head. They cannot be described simply as "thread-shaped hooks,'" to use Ludwig's phrase, or as "knobbed processes," according to Professor Thomson's description. They vary so much in shape that hardly two are alike. Most of them may be likened to a bent and half-closed hand, the wrist very slender and the fingers much flattened. Inside each finger tip, a cushion or pad studded with short but very sharp points occurs. Some of the expanded hands or heads possess two fingers only, others have three, but a great many have four, and a few seem to possess five. Usually the fingers are curved over as described, but many are bent in various ways, some turned up, or twisted sideways, just as the fingers of the hand may be variously contorted. The whole of the flattened edge of the "finger tip" may in some cases be studded with minute denticles or teeth; indeed these toothed surfaces are so variously turned that they grasp or cling to anything and everything which comes in contact with them. When once hooked to any object they are as difficult to detach as some of the familiar seeds which cling to one's clothing when walking through the bush. The eggs were entangled with each other when I first examined them, and they could be separated only at the risk of tearing off some of the hooked threads.

These rare and interesting specimens were procured by a Bay of Fundy fisherman, attached to each other, and to the rope or line of a baited trawl set for pollack, between Campbell's Island and the Wolves, New Brunswick, where the depth ranges from 40 to 50 and, in some places, 70 fathoms. The parent fish are said to burrow in the mud or sand at depths of 40 to 300 fathoms, and to protrude the snout only, so that they are rarely procured, excepting when they emerge and swim about in search of prey. As already stated, they bore into hooked cod and haddock, passing eel-like into the abdominal cavity of the fish, or at times they suck in the baited hook set for superior fish, and the hook is swallowed so far down the gullet that the fishermen usually cut off the head of the hagfish, to make them disgorge the hook being practically impossible.

A SUGGESTIVE NOTE AS TO WHAT MIGHT BE BROUGHT TO LIGHT ABOUT THE PADDLEFISH THROUGH DEEP LAKE DREDGING.*

BY ANDREW HALKETT.

One of the most remarkable things in modern biological research concerns what has been brought to light through deep sea dredging. Many new species of fishes, often grotesque in appearance, constructed so as to resist pressure, and many of them furnished with phosphorescent organs enabling them to see in the darkness of the abyss, have through such researches been added to the list. An instance of the kind from our own marine waters relates to the only specimen known of *Raja abyssicola*—a male obtained at a depth to 1,588 fathoms from off the coast of the Queen Charlotte Islands, British Columbia. Upon this fish, in my "Check List of the Fishes of the Dominion of Canada and Newfoundland," I bestowed the vernacular name of Deep Sea Ray; and in a foot note, here quoted from that work, I drew attention to that remarkable find:—

"No ray was ever found at any such a depth as this before. A ray from a depth of 565 fathoms is included in the list of deepsea fishes obtained by the dredgings of the 'Challenger' (Günther), and '*R. mamillidens*', a uniform jet-black species, has been obtained from a depth of 597 fathoms in the Bay of Bengal' (Bridge), but as far as available records show, none have been obtained at a greater depth than some 600 fathoms except this one."

Now, it has occurred to me, for reasons presently to be pointed out, that possibly something concerns the distribution of the Paddlefish ((*Polyodon spathula*), which as yet is unknown. This singular fish still exists in plenty in the Mississippi Valley, and in waters of the southern United States, besides which, at exceedingly rare intervals, it has been found in waters of the Great Lakes system, its records, as again quoted from my "Check List," being these:—

"Exceedingly rare in Canada—the following appearing to be its records: Lake Huron, near Sarnia, Ontario (two specimens); Spanish River, District of Sudbury (one specimen); Lake Helen, Nipigon River (one specimen); Lake Erie (if from the Canadian side of the lake—one specimen): plentiful in the Mississippi valley and southern United States: also recorded from Ohio River (LeSueur, 1817, as *Platirostra eden-*

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tula; and Rafinesque, 1820, as *Acipenser lagenarius*); and from Lake Ontario (Rafinesque, 1820, as *Proceros vittatus*)."

Supplementing its records, a quotation from Dr. Prince, given as a foot note in the Check List, is introduced here:—

"Old fishermen near Point Edward, on the Lambton county shore, vaguely refer to other specimens occurring in Lake Huron."

The form and structure of the paddle-fish determine it to be a species whose habitat is at the bed of the rivers or lakes where ordinarily it occurs. The fusiform body is little compressed, and its long spatulate and somewhat flexible blade, preçeding the rest of the head, enables it to scoop among the mud or ooze in the obtaining of its food. It is probably for this reason that it has seldom been found in lakes or rivers tributory to such deep lakes as Lakes Superior and Huron are, and the inference is that it normally remains in the depths; and whilst it is true that individuals of this fish have been found with ripe eggs in Kentucky, in the month of May, and that the paddle-fish was then swimming up stream, so that it has been supposed to spawn in bayous along the river, yet its spawning grounds do not appear to have been located; besides which the fry are entirely unknown, and the young of the paddle-fish, even where it occurs plentifully in the United States, has never been found of a length less than about six inches.

The idea that the paddle-fish normally remains in the depths, or even spawns there, is perhaps strengthened by what is known concerning the structure and habits of its only immediate ally, the fish known as *Psephurus gladius* of great rivers of China, such as the Hoangho and Yang-tse-Kiang. That fish, which is said to attain the great length of twenty feet, has a rostrum of conical shape instead of a spatulate blade like that of the paddle-fish, but this organ also serves the purpose of scooping in the mud; and it may therefore readily be seen how well it is equipped for living at the beds of those great rivers in China, which appear locally to vary in their character from clear and sparkling to turbid and muddy.

This suggestive note claims to be no more than a hypothesis, but the idea seemed to commend itself to Dr. Garman, the ichthyologist of the Cambridge, Mass., University, and to Dr. Hussakof, the palaeontologist of the American Museum of Natural History, New York, to whom I mentioned it; and these gentlemen seemed to share my opinion that there is no saying what deep lake dredging, carried on after the manner of deep sea dredging, which has been so prolific in what it has yielded, might bring to light concerning the paddle-fish which otherwise must remain unknown.

BOOK NOTICE.

A LIST OF CANADIAN MINERAL OCCURENCES. BY R. A. A. JOHNSTON, OTTAWA, 1915, GEOLOGICAL SURVEY OF CANADA.

In view of the great advance of the mineral industry of Canada in recent years, a complete list of its minerals and their localities has been much desired. Such a list now appears among the publications of the Geological Survey, and the compiler, Mr. R. A. A. Johnston, mineralogist of the Geological Survey, is to be congratulated upon the thoroughness of the work.

As is usual in such lists, the work is divided into two parts, the first of which discusses the minerals and indicates the localities where each mineral is found, while the second part contains a list of localities and indicates the minerals to be found in each place.

In view of the rapid development of the country involving changes in the boundaries of districts, it was hardly to be expected that the mineral occurrences should always be listed under the districts as they exist to-day. This difficulty is illustrated by the District of Nipissing, which in recent years has been sub-divided so that portions of the original district are now contained in four districts. In a few instances Mr. Johnston has failed to make the necessary readjustments, particularly in regard to Algoma and Kenora districts. There are some errors as to the chemical composition of minerals, as illustrated by breithauptite, which is an antimonide of nickel rather than of iron.

Unfortunately the localities recorded by Dr. J. J. Bigsby and by Dr. Samuel Robinson have been largely ignored, though some of Bigsby's localities are mentioned. In some cases proper references are given, while in others this has not been done. In the case of beryl from Rainy Lake, the reference is to a Geological Survey Report, but in that publication Dr. Bigsby is given credit for the locality. Interesting omissions are the staurolite on La Croix or Namaycan River, the jasper on Gunflint Lake, celestite from Lake Simcoe, and selenite from Manitoulin Island, which were mentioned by Dr. Bigsby (American Journal of Science, vol. 8, p. 60 et seq.)

In spite of these minor defects, this book is of a character in press work, plan and contents to take its place besides such noted works as Robinson's American Mineral Localities and Dana's Catalogue of American Localities of Minerals.

T. L. WALKER.

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FOSSIL COLLECTING.*

By E. M. Kindle.

Introduction.

Away back in the mists of antiquity, so long ago that no record of him survives, "some pastoral savage, more reflective and less practical than his brethren," made the first collection of fossils and placed them in front of his tepee. From the time of this first unrecorded collector to the present, most thoughtful and reflective men have some time or other felt the spell of the past which the discovery of the fossil remains of extinct animals casts over the mind, and have become temporarily at least collectors of fossils. Even statesmen burdened with the affairs of nations have found time to collect fossils. It is related of Thomas Jefferson that when he journeyed on horseback from his Virginia home to Philadelphia to be inaugurated President of the United States, he carried with him in his saddle bags some fossils which he wished to submit to the Philadelphia savants.

From the rude mound of fossils so often met with in the farm-house front yard, or the mantlepiece collection in the mountain cabin, to the great collections of our large geological museums, is a long step, but the former may be regarded as the prototypes of the latter. The mantlepiece and front yard collections usually have slight value because no record of the exact locality of the several specimens has been preserved. The museum collection should show not only the geographical source of the fossils but their geological horizon as well. In other words the fossil exhibits of a properly arranged museum show the specimens in both their space and time relations. The fossil exhibits of large museums like the British Museum show the ancient life of the world in epitome. The educational value of the great museums of geology depends largely upon the extent to which the visitor has prepared himself to understand their message. There is no preparation for receiving the knowledge which museums and books on geology have to offer which will compare with the use of the hammer and chisel in collecting fossils from nature's own museum. It is the object of this paper to encourage the reader to collect fossils in such a way that their scientific value will not be impaired or destroyed, as often happens through the use of improper methods.

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COLLECTING METHODS.*

In collecting fossils a rather heavy hammer is indispensible. Many palaeontologists prefer the ordinary bricklayer's hammer, with its long broad blade, which is very effective in splitting open blocks of rock and in digging in shales. A small chisel is frequently useful, and a note book should be carried. A tube of glue and a small vial of hydrochloric acid are valuable adjuncts to the collector's outfit. A bag or basket with a supply of old newspapers or tissue paper for wrapping specimens, together with a substantial lunch, complete the essential elements of the collector's outfit for a day in the field.

There is no royal road to finding fossils. But success usually comes to the collector who prostrates himself on the ledges and searches the beds foot by foot as he crawls over the surface. Beds which are nearly or quite barren of fossils are often separated by comparatively thin bands in which fossils abound. Much patience and close scrutiny are often required to detect these rich beds. In this work haste has no place, and keen eyesight plays the same role in finding fossil animals that it does in hunting living ones. Sometimes the fossils are composed of harder material than the enclosing rock, and stand out in strong relief on the surface of the ledge. In such cases they are easily found. But more frequently the only clue to the presence of fossils is the indistinct outline on the surface of the rock of the cross section of fossil shells, which have little resemblance to the specimens as they appear after removal from the matrix. Where the fossils occur in shales they are often found lying loose on the surface, having been set free by weathering.

If the collector wishes the fossils which he finds to have scientific value he must keep a systematic record of the exact geographic locality from which each lot comes. This is easily done by keeping a numbered record in a note book of the collecting stations, and attaching a corresponding number to each lot of fossils collected. It should be the practice of the collector or field geologist to prepare for each specimen or group of specimens a field label before leaving the collecting station, giving:

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*No attempt is made here to discuss methods of collecting vertebrate fossils.

(*a*) the serial field number assigned to it, (*b*) a precise definition of the locality from which the specimen was taken, (*c*) name and formation, if known, (*d*) the relationship to each other of the beds from which different lots of fossils have been taken—best shown by reference to a section in the note book of the beds collected from—(*e*) name of collector, (*f*) date: day, month and year; (*g*) number and page of field note book in which the section or bed furnishing the collection is described. The serial field number placed on the label should appear in the note book in connection with the description of the part of the section or bed from which the specimen was obtained. All specimens taken from one bed in one locality, whether representing one or more species or individuals, should be given the same number and label. Fossils collected from different beds, even when only a few feet apart, should as a rule be given distinctive labels, and specimens taken from talus slopes or boulders should be kept separate from those found in place. As a rule, each individual fossil should be wrapped separately in newspaper or tissue paper at the locality where collected. Where the specimens are very fragile, like the shells of the post glacial clays of the Ottawa valley, for example, cotton batting and small vials or pasteboard boxes are required to protect the specimens from breaking. A single label will suffice for all the specimens from one collecting station if heavy manilla paper is used in making them into a secure package. This should be numbered on the outside in addition to having a label inside. Abundant material should be obtained wherever circumstances permit.

The preservation of both the moulds and casts of a fossil where the original material of the fossil has been removed is most important. All of the parts of a broken specimen should be carefully preserved and kept together. A tube of glue for repairing broken specimens should always be included in the collector's outfit. The collector should bear in mind the fact that his collection of fossils may be of much value in furnishing new data regarding the stratigraphic range and geographic distribution of species.

In collecting from a section where a considerable thickness of rock, with several fossiliferous beds, is exposed, the section should be measured as collecting proceeds. The section may be given a number, and each subdivision of it designated by a letter of the alphabet, the several lots of fossils from the different levels being marked with their respective letters. Detailed information concerning the physical and chemical characteristics of each subdivision of the section should be recorded. If the section studied is exposed along the sides of a gorge, a simple method of measuring the beds collected from is to cut a light pole 10 or 15 feet in length and mark it with bands of peeled bark at intervals of 5 feet, one of the 5-foot subdivisions being marked off into 1-foot spaces. The section can then be measured by holding the pole at right angles to the bedding and using it yard-stick fashion. In the case of horizontal beds exposed along the slope of a hill or mountain-side, the aneroid barometer or a Locke's hand level is generally used. When the beds are inclined, neither of these instruments will suffice. The method used by Blackwelder for measuring sections of inclined strata is a modification of the Walcott method, and includes the use of a clinometer compass attached to a rod 5 feet 1 inch in length. Walcott describes this method as follows:—

"The strata, in section to be measured, were inclined to the east 40°. Placing the lower end of the rod at the base of the section, I inclined the rod towards the edges of, and at a right angle to, the line of the dip of the strata, which was indicated by the needle of the clinometer standing at 40°. Then, looking through the compass sights the point where the line of sight touched the ground was marked as the next station for the rod, and on this station the base of the rod was placed for the second sight, which was made exactly as in the first instance, and so on to the end of the section. Frequent trials were made, at the exposed outcrops, to determine the angle of dip of the strata, so that the rod might be held at a right angle to it."

The application of this method is clearly shown by Blackwelder's figure which is given below.

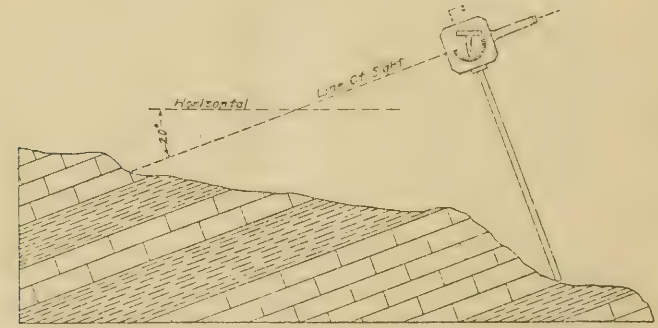

Fig. 1. Diagram illustrating the measurement of strata by means of a spirit level clinometer and sighting arm attached to a five-foot rod. (After Blackwelder.)

In case the collector is not provided with a clinometer compass, fairly accurate measurement of a section of inclined beds may be made with the aid of a roughly improvised T-shaped square. The long arm should be of a known length. The T-shaped staff when used is held vertical to the surface of the inclined beds to be measured, while the eye sights along the short arm in a direction at right angles to the line of strike to a point on the ground which will be the next station base for the staff. Each station occupied will have an elevation above the preceding one in the section corresponding to the length of the staff.

OBJECTS SOUGHT.

Brief consideration of some of the purposes for which fossils are collected will indicate to what extent the methods outlined in the preceding pages are essential in different classes of work, and whether they may be expanded or shortened in connection with collecting which has different objects in view.

There is probably no other branch of natural history collecting which may lead to the solution of such a variety of problems as the collecting of fossils. The problems of the the palaeontologist include within their range those of structural geology, the restoration of ancient physical geographies, and the problem of evolution. Whatever the purpose of the collector may be, however, the precise location of the rocks furnishing the specimens and their relationship to other beds in the locality should always appear on the locality label.

During an earlier stage in the development of palaeontology the discovery of new species was the ultima thule of the collector. This is still an important and legitimate object of the collector's work, for many thousands of species as yet unknown to science doubtless remain to be discovered, described and systematically placed in the immense catalogue of the earth's extinct life. Many collectors and palaeontologists of an earlier generation were content to refer their new species to the Lower Carboniferous, the Upper Silurian, or to a major division of whatever system they were derived from. Our present ideal, though not always attained, is to indicate the place of a new species in the section where discovered with the utmost exactness. This kind of painstaking care on the part of the collector and the author of a new species will ultimately, if not at once, make possible its reference to its proper place in the general geological time scale with a precision comparable to that with which the railway engineer refers a particular station on his line to its exact position above sea level. This tendency toward greater refinement and precision in the methods of the palaeontologist is one of the factors which has lead to an extensive revision and expansion of formational nomenclature. The description of a new species, important as it is, can at present be regarded as only one of several objects to be attained through the collection and study of fossils. The description of fossils is in fact only the first step in their use for the purpose of correlation in palaeogeography, attacking the far-reaching problems of evolution.

It is worth while recalling here that Wm. Smith, the father of stratigraphic palaeontology, made excellent use of certain fossils even before they were named in tracing the formations which they characterized over a great part of England. Smith's discovery of the value of fossils in correlation enabled him to prepare the first geological map of which we have any record. The fundamental importance of fossils to the geologist in enabling him to recognize or identify the same beds in different areas has been universally recognized since the days of Wm. Smith. It is for this purpose that the fossil collections of the field geologist are generally made. They necessarily often represent a great many localities, and frequently a small number of specimens from the individual localities which may or may not be as large as the conditions incident to the work will permit, and the preparation of stratigraphic sections in connection with them is most important.

Progress in stratigraphic palaeontology in recent years has been largely along the line of increasing our knowledge of the range and distribution of faunas, and of the individual species composing them. The important bearing of this class of knowledge upon questions concerning the evolution and dispersal of faunas is evident. Its interest to the general geologist lies chiefly in the fact that the accuracy with which fossils can be used in correlation is in direct proportion to the completeness of our knowledge of their range. The presence in certain areas of recurrent faunas or faunas which re-appear at higher levels after completely disappearing for a considerable interval from a series of beds, sometimes introduces for particular regions a new and difficult factor into the use of fossils in correlation until the inter-relations of the recurrent with the associated faunas has been worked out. Such areas require an amount of collecting and careful comparison of faunas and sections which would be unnecessary in ordinary regions. The recurrence in the Devonian section of southern New York of *Tropidoleptus carinatus* in the Chemung, 2,000 feet above its disappearance at the top of the Hamilton formation, is an example of this phenomenon.* (See fig. 2.) We learn from it and similar examples that the disappearance of a fossil from a section may not mean that it has become extinct, but that it has changed its habitat.

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*E. M. Kindle, Jour. Geol., vol. XIX, pp. 346-347, 1911.

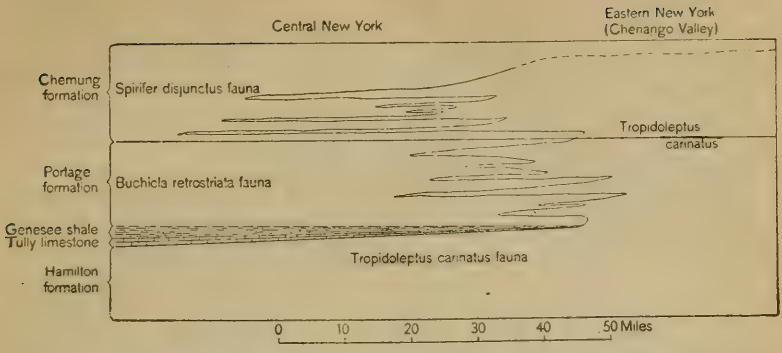
Central New York
Eastern New York (Chenango Valley)
Chemung formation
Spirifer disjunctus fauna
Tropidoleptus carinatus
Portage formation
Buchiola retrostriata fauna
Genesee shale
Tully limestone
Hamilton formation
Tropidoleptus carinatus fauna
0
10
20
30
40
50 Miles

Fig. 2. A diagrammatic east-west cross-section of the Middle and Upper Devonian of southern New York, showing the relations of *Tropidoleptus carinatus* to the western faunas during Portage and Chemung time. Total thickness of the section is about 2,700 feet.

The presence of a recurrent Hamilton species like *Tropidoleptus carinatus* in the Chemung fauna of southern New York involves its withdrawal from at least the major part of the New York area at the end of Hamilton sedimentation to some part of the sea furnishing a more congenial environment than that which accompanied Genesee and Portage sedimentation. In the newly adopted habitat, or in a small portion of the old one, it found a haven where those conditions of the Hamilton sea which were essential to its life were maintained throughout Genesee and Portage time. With the initiation of Chemung sedimentation *T. carinatus* extended its habitat back again over a part of the area which it had previously occupied, as shown in fig. 2.

These recurrent faunas furnish convincing evidence of the existence during the Palaeozoic of distinct faunal provinces. It seems safe to conclude that the recurrence of a fauna has been due to the oscillation or migration of the factors which conditioned its geographic distribution.

Palaeogeography is a field of knowledge to the extension of which the collection of fossils contributes most important data. Collections which will contribute most to this subject are those concerning which the collector has supplied, in addition to the data already mentioned under methods of collecting, complete data regarding the physical features of the rocks in which they are found. This physical data should indicate very fully the nature of the sediments associated with individual faunules, as to composition, texture, hardness and colour. The collector should note the character of the lamination, whether in thin or thick sheets or variable, and whether uniform or alternating composition characterizes the beds. The presence or absence of cross bedding, ripple marks, current marks and wave marks should be noted with care. The direction of these features when successive beds show a degree of uniformity should be noted. Particular attention should be given to observing the amplitude of ripple marks, and whether they are symmetrical or asymmetrical. A great predominance of one or the other type of ripple mark may, as I have elsewhere shown,* afford conclusive evidence regarding the continental or marine origin of a set of beds. Mud cracks, rain drop impressions, and other features characteristic of the intertidal zone, should be looked for with the greatest care by the collector.

It is true that the literature treating of fossils seldom gives much data of this kind. The palaeogeographer in making use of fossils in drawing the boundaries of ancient seas, has had but little data of this class to curb his imagination or stay his hand. Structural features of comparatively recent origin have too often assumed for him a significance which they did not possess, while the really significant features indicating proximity to a shore line were neglected because unrecorded by palaeontologists and geologists.

The observation and record of the physical characters which have just been enumerated are of the utmost importance in connection with the collection of certain classes of fossils, like the eurypterids and certain fishes whose normal habitat is still a subject of discussion. It is to the careful study of the physical features of the beds enclosing such fossils that we must look for the solution of the problems relating to the character of their habitat.

Zoology gave to the world the hypothesis of evolution, but its demonstration and its actual history is the province of palaeontology. It is the privilege of the collector of fossils to assist in discovering the actual course which the steady upward trend of life has followed through the geologic ages. For the study of problems relating to orthogenesis, saltation and other elements in evolution, fossils offer a great advantage over living animals and plants. The time element in the latter is an undetermined factor, while in the geological section its value may be determined. Zoologists are too little acquainted with the excellent results which have been attained in this field through the work of such men as Waagen on mutation, Hyatt on the cephalopods, and Beecher on the evolution of spines. Only very well preserved material can be utilized in studies of this class. The collector of perfectly preserved fossils derives an added pleasure from his work through knowing that it may be of value in contributing to the solution of some of the most fundamental problems of the organic world.

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*Recent and Fossil Ripple Marks (in Press).

"GLEANINGS IN FERNLAND."

By Frank Morris, Peterborough Cgllegiate.

(*Continued from page* 110.)

From our summer schedule of trips, the first place to suffer a "washout" this wet season was the Bruce Peninsula between Wiarton and Tobermory; the next was Manitoulin Island, where the Parsley Fern has been recorded; and the third was the north margin of Twin Lake, near Port Sydney. Here grows a magnificent colony of the Virginia Chain Fern (and with it the handsome rein-orchid *Habenaria blephariglottis*). The Woodwardia I have never found except here, and, as you may remember from our "field day" in 1910, the sight of it in its ordered ranks made a profound impression. The fronds seemed all standing to attention, and facing one way out over the "mud lake" from their beds of sphagnum, buckbeans, cranberry, and plants of the heath family. I suggested that sunlight was the key to the mystery, for it certainly was mysterious to see those silent forms standing in the midst of an open space in the heart of forest and swamp, as though all endowed with one conscious purpose, and obeying some unseen power: "Eyes front!" and every member of every rank stood focused to the same point in space. This was one of the "moot questions" referred to before. The fern is peculiarly fond of moisture, often growing submerged in water, and spreading, by very long runners under the surface. Just as the fruiting pinnae of the Crested Fern are twisted into a new plane at right angles to the rhachis in order to protect the sporangia from the sun's rays, so where there are not shrubs enough to throw healing shadows for a colony of Virginia Chain Fern, every stalk will be found twisted on the underground runner so as to face due south to the sun at its zenith; by keeping "eyes front" to the foe, the fronds preserve the spore-cases from parching and evaporation. This was first observed by D. C. Eaton, author of "Ferns of North America."

A second moot point was the determination of one of the smaller species of *Botrychium*. This was a plant first found by me under cedars fringing the tamarack swamp near Newtonville. The first colony was discovered west of the corduroy road that leads to Starkville. Since then I have found the plant—in hundreds—at nearly a dozen points, over a space whose diameter is perhaps 1½ miles. I have also found it in the neighbourhood of the Rideau, of Stony Lake, of Peterborough, and of Garden Hill. Always under cedars in rich swamps, usually in thin moss, occasionally in sphagnum, often in detritus of cedar and spruce. It has always been, to my mind, a form of *B. simplex* peculiar to moist, shady situations. The plant ranges from 2 or 3 to 6 or 8 inches in height. The barren frond consists of from one to four or five pairs of lunate sessile lobes, opposite to alternate, and terminates in a notched lobe. This barren leaf is decidedly fleshy; apparently the plant seldom lives more than three or four seasons, for though in a colony I have found hundreds of plants, the vast majority appear to have sprung recently from wind-blown spores, and to be not more than two years old. Very rarely large plants are found with four or five pairs of lobes on the barren frond, and, still more rarely, in such patriarchs of the colony the basal pair of lobes show a tendency to become compound by branching out into similar lobes. My first specimens were sent to the late Prof. Fletcher, in Ottawa. He inclined to think them *B. matricariae* (*ramosum*), but was not familiar with these smaller members of the genus, so handed them over to Prof. Macoun. He also thought them *B. matricariae*.

Next season I found the genuine *B. matricariae* by hundreds in the Algonquin Park, but remained convinced that my earlier find was *B. simplex*. Later on I found the strange fern in the Rideau district, and still never wavered, though I was unable to get more than a doubtful assent to my view from other collectors in the Province. Then I sent specimens of both ferns to W. N. Clute, of the Fern Bulletin, but to my chagrin he too pronounced the stranger a variety of the Matricary Fern; luck was against me, it seemed the wind simply *wouldn't* blow my way. At last (more than four years ago) I sent specimens to Prof. Robinson, of the Asa Gray Herbarium, and waited for nearly a year. Then I wrote again, and heard that my first consignment had gone astray or been lost. By this time I was desperate, but made my last venture with a parcel of specimens to Harvard, from five or six different localities. My Argosy came to port safely with its precious cargo, and I got word that every specimen forwarded in the half-dozen sheets of plants, was undoubtedly *B. simplex*.

If the last week in Owen Sound was wet, our three weeks under canvas on Birch Island were to prove little better. But we managed to snatch a few days and half days out of the deluge and salvage them to some profit. We gathered blackberries and raspberries galore; we caught lake trout and black bass, we made flapjacks and jam, and ate them too; and every now and then we paddled our own canoe (a new one) to various portages and explored the trails. Once I made my way to the back of "Skymount" and gathered in, from a certain trough of the hardwoods that I had found years before, specimens of

Botrychium ramosum and *Botrychium lanceolatum*, and on the return trip (for curiosity) *Botrychium Virginianum* and *Botrychium ternatum*. Another day, after gathering plants of *Aspidium fragrans* from a cliff overlooking the lumber slide on the Madawaska, I crossed the railway and explored the woods for shaded cliffs. Here I stumbled on a veritable El Dorado, for on three successive outcrops of rock in the depths of the forest, I found clump after clump of silvery green fronds—the Fragrant Shield Fern in all its aromatic loveliness. Passing out from the woods to the cliff exposed at the lake shore, I found dense masses of *Woodsia ilvensis*, but no more *Aspidium fragrans*.

These two or three trips sent my enthusiasm up to fever heat, and whenever I saw a piece of woodland, the botanist in me ettled to explore it, and as the woods were everywhere, I was forever diving into their recesses and carefully scanning the ground for some lilliputian treasure, or hurrying over to a line of cliffs in the background.

That will-o'-the-wisp of the unknown led me many a dance all to no purpose; but one day, while exploring a piece of cliff near one of the trails, I found a small fern growing in the rock seams that I could not reconcile with any familiar species. It was much like the Brittle Bladder-fern in frond, but the rootstock was different; it was very much like the Rusty Woodsia, but neither "rusty" nor jointed; it grew in loose, detached moss at the base of the cliff, up and down a vertical seam, along a horizontal ledge, and inside a crevice some 20 feet up; it extended over 30 or 40 yards of the cliff, and formed a colony of three or four score plants. It was closely tufted, the stipes were dark brown, and the rhachis and frond covered with white hairs and yellow resinous glands. I had no microscope, nor even a table, in camp, but I made the plant out to be *Woodsia scopulina*. A guest in our camp, who scorns to be initiated into the noble brotherhood of "men of grass" (to use the title given to Douglas by the Indians), went so far as to school his wife to greet me on my return to civilization with the magic password: "Woodsia Scopulina." I understand there were dress rehearsals of the scene, but the best laid schemes of mice and men gang aft agley, and when there fell on my ear words that sounded like "Woodulina Scopsia," I was only a little less bewildered than the old bishop who, wakened out of slumber at a country vicarage by a thunderous knock at his bedroom door, and asking in quavering tones "Who's there?" heard the appalling response: "The Lord, my boy."

Specimens of the new find were sent to the Asa Gray Herbarium at Harvard, and identified at first sight as *Woodsia obtusa*, but Mr. J. M. Macoun, at the Victoria Museum, Ottawa, and (I believe) Prof. Fernald, of Harvard, both inclined to the view that it was *W. scopulina.* Accordingly I sent the plant to Prof. Maxon, of the Smithsonian Institution, and in due course heard from him that the plant was undoubtedly *Woodsia scopulina*, and this has now been corroborated at Harvard.

By way of summary. The list of our finds in 1910 amounted to 37, but since then two varieties have been given specific importance, viz., *Aspidium bootii* and *Botrychium obliquum*; so our list was virtually 39. Add *Pellaea densa* from near Durham, and the Parsley Fern from Manitoulin, and you have 41. The six new species added to our list this season make a total of 47, and all these in *old* Ontario—I mean from Detroit in the west to Montreal in the east—and for northern marches, the French River, Lake Nipissing, and the Mattawan. In New Ontario, between the Lake of the Woods, James Bay and Lake Abitibi, some seven more species are known to occur, and of these, it seems to me quite likely that two or three at least may be discovered by some happy enthusiast nestling among the thousand-and-one yet unsearched nooks and crannies this side of North Bay. I will end our ramble by listing the fern-flora of the Province:—

I.	1.	Polypodium vulgare.
II.	2.	Phegopteris polypodioides.
“	3.	“ hexagonoptera.
“	4.	“ dryopteris.
III.	5.	Adiantum pedatum.
IV.	6.	Pteris aquilina.
V.	7.	Pellaea atropurpuria.
VI.	8.	Cryptogramma densa.
“	9.	“ acrostichoides.
“	10.	“ stelleri.
VII.	11.	Woodwardia virginica.
VIII.	12.	Asplenium viride.
“	13.	“ trichomanes.
“	14.	“ platyneuron.
“	15.	“ angustifolium.
“	16.	“ acrostichoides.
“	17.	“ filix-femina.
IX.	18.	Scolopendrium vulgare.
X.	19.	Comptosorus rhizophyllus.
XI.	20.	Polystichum acrostichoides.
“	21.	“ lonchitis.
XII.	22.	Aspidium thelypteris.
“	23.	“ noveboracense.
“	24.	“ fragrans.

XII.	25.	Aspidium marginale.
“	26.	“ filix-mas.
“	27.	“ goldianum.
“	28.	“ bootii.
“	29.	“ cristatum.
“	30.	“ spinulosum.
XIII.	31.	Cystopteris bulbifera.
“	32.	“ fragilis.
XIV.	33.	Woodsia ilvensis.
“	34.	“ scopulina.
XV.	35.	Dicksonia punctilobula.
XVI.	36.	Onoclea sensibilis.
“	37.	“ struthiopteris.
XVII.	38.	Osmunda regalis.
“	39.	“ claytoniana.
“	40.	“ cinnamomea.
XVIII.	41.	Ophioglossum vulgatum.
XIX.	42.	Botrychium simplex.
“	43.	“ lanceolatum.
“	44.	“ ramosum.
“	45.	“ obliquum.
“	46.	“ ternatum.
“	47.	“ virginianum.

Ontario, N. and N.W.

II.	48.	Phegopteris robertiana.
VIII.	49.	Asplenium ruta-muraria (?).
XIII.	50.	Cystopteris montana.
XIV.	51.	Woodsia glabella.
“	52.	“ hyperborea.
“	53.	“ oregana.
XIX.	54.	Botrychium lunaria.

BUPRESTIDÆ KNOWN TO OCCUR IN THE OTTAWA DISTRICT.

By Bro. Germain, of the Christian Schools, Académie De La Salle, Trois-Rivières.

In 1909, Mr. G. Chagnon published an interesting monograph of the Buprestidæ of Quebec. Practically all of the species mentioned were recorded from Montreal, Rigaud, and a few from Hull. The following is a list of these interesting beetles which the writer has captured in the Ottawa district. I hope it will prove of value to Canadian coleopterists. The asterisks indicate those species which are not included in the literature above mentioned. The numbers preceding each species are those given in Henshaw's List of Coleoptera of America, North of Mexico:—

CHALCOPHORA Sol.

4568—angulicollis Lec.
4569—virginiensis Drury.
4570—liberta Germ.
4572—fortis Lec.

DICERCA Esch.

4576—prolongata Lec.
4577—divaricata Say.
*4578—pugionata Germ.
caudata Lec.
4579—obscura Fab.
4583—tenebrosa Kirby.
4585—tuberculata Chev.

POECILONOTA Esch.

4594—cyanipes Say.

BUPRESTIS Linn.

*4598—rufipes Oliv.
4601—lineata Fab.
4602—consularis Gory.
4604—nuttalli Kirby.
4606—maculiventris Say.
4607—fasciata Fab.
*4608—sulcicollis Lec. (1 sp. det. by Schwarz).
4609—striata Fab.

MELANOPHILA Esch.

4619—logipes Say. (acuminnata DeG.)
4621—drummondi Kirby.
4622—fulvoguttata Lec.

ANTHAXIA Esch.

4630—viridifrons Lap.
*4631—viridicornis Say.
4633—quercata Fab.

CHRYSOBOTHRIS Esch.

4639—femorata Fab.
4640—floricola Gory.
4647—dentipes Germ.

Chrysobothris Esch. (continued).

4650—trinervia Kirby.
4651—scabripennis Lap.& Gory
*4652—pusilla Lap. & Gory. (Ent. Rec. 1901).
4657—sexsignata Say.
4658—chrysoela Ill.
*4660—azurea Lec.
4661—harrisii Hentz.

ACMÆODERA Esch.

4699—pulchella Hbst. (Ent. Rec. 1901.)
4707—culta Web. (Ent. Rec. 1901.)

EUPRISTOCERUS Deyr.

4718—cogitans Web.

AGRILUS Steph.

4721—ruficollis Fab.
4724—otiosus Say.
*4724*a*–pusillus Say.
4727—bilineatus Web.
4731—fallax Say.
4738—acutipennis Mann.
4739—anxius Gory.
4742—politus Say.
4746—egenus Gory.
10109—obsoletoguttatus Gory.
10112—masculinus Horn.
*10118—pensus Horn.
10119—blanchardi Horn.

TAPHROCERUS Sol .

4755—gracilis Say.

BRACHYS Sol.

4758—ovata Web.
4761—aerosa Melsh.
4762—aeruginosa Gory.

PACHYSCELUS Sol.

4766—laevigatus Say.

MUSEUMS AS AIDS TO FORESTRY.

BY HARLAN I. SMITH, GEOLOGICAL SURVEY, OTTAWA.

In gaining due recognition and support from the great mass of the people, museums may be great aids to forestry. Even the further application of museum methods in forestry, may be of valuable service. The extent of the possibilities in these lines of recruiting aid by means of museum methods of publicity, recreation, instruction and research can hardly be forecast. Such museums or methods, however, must be properly administered to be effective. The methods used, for intance, in the large and costly Botanical Museum in New York, would be of little or no avail to forestry. That museum may be of use to scientists, but is not of much human interest to me, and, therefore, I judge, not to the average citizen, lumberman or forester.

Vast expenditure of time and money is not necessarily needed to secure valuable aid by these means. Museum cases, if such are really required, may be made at a cost of less then four dollars per foot front, as I have pointed out in THE OTTAWA NATURALIST of May, 1915, and The Scientific American of May 29, 1915. A large collection of specimens, maps, photographs and labels is not needed to inoculate whole regions with the germs of the ideas of the practicability and economic importance, to say nothing of aesthetic values and the love of forestry. A small exhibit may teach the general and valuable principles of forestry, perhaps even better than a complete exhibit of all kinds of trees, such as is shown in the American Museum of Natural History in New York. Such a complete exhibit might confuse or burden. The persons to be influenced to give aid to forestry might be lost in the woods as it were.

In the Rocky Mountains Park Museum at Banff, Alberta, a beginning to a tree exhibit has been made. There are eleven species of trees in the Park. Five grow in the valley, but the other six are found only on the higher land. A complete collection of the trunks and leaves of the trees growing in the valley was made in two half days as a bi-product of other work, and without any expense except as for time in cutting the trunks to lengths for exhibition. At the same time two photographs were made of each of these five kinds of trees; one of a grove or group of each kind of tree from a distance, and one of the details of the trunk, bark, leaves and such flowers or fruits as were then in season. Later photographs are to be made of the parts of the trees not yet taken, and of uses and abuses of each tree and its products. Tentative labels had previously been prepared at my request by the late Mr. Abraham Knechtel, Chief Forester of the Parks Branch of the Department of the Interior. These refer particularly to the Park, and consequently are to be revised, so as to serve as labels to the same trees in any other museums that may accept the labels. Supplementary labels describing the peculiarities of the same trees as to the Park are also in preparation. These labels were printed in the Handbook of the Rocky Mountains Park Museum, and from the same type the labels were printed for labelling the specimens in the museum. The museum labels were printed on card of a yellow colour to harmonize with the furniture of the museum, and with a brown ink for the same purpose. They were framed and securely screwed to the trunks of the specimens, so that they cannot easily be displaced. The glass covering them, which can be cleaned readily by any janitor, protects the label from dirt or breakage. When these labels are revised to include instruction and explanation of the most important of the forestry abuses and needs, and when specimens of uses of the lumber and other tree products, such as wood alcohol, charcoal and turpentine, are added with full labels, this exhibit will be the beginning of a suggestion for a museum aid to forestry. An example of such a fact as should go in a label is that the obnoxious pitch of the balsam is so largely in the bark that the wood, formerly not used at all for paper pulp, is exceptionally valuable for this purpose. The qualities of a great number of woods may be shown by the exhibition of the volumes of American Woods published by Hough, illustrated by cross radial and longitudinal sections of actual trees. But certainly to accomplish the best results expert foresters who know the scientific facts must co-operate with those who understand people well enough to translate forestry facts into terms that not only can be understood by those whom forestry seeks to convert to its aid, but into terms that will also attract those people to read the labels and study the specimens.

The same labels may serve as outlines for lectures, each label being illustrated by lantern slides made from the photographic negatives previously mentioned. It is part of the work of all progressive museums to give popular lecture interpretations of science, as well as scientific lectures and recreation based on instruction. Then, too, the museum may send out both travelling exhibits of forestry and lecture outlines made up of the labels together with loan sets of lantern slides.

The President of the Ohio Academy of Science, speaking at the 25th anniversary of the Academy, stated that the existence of the Academy was unknown to the great majority of the people of Ohio, and a "Pan-American Scientific Congress" was organized last month in Washington, under the chairmanship of the third assistant United States Secretary of State, with a program of nine sections, but ignoring Canada, and also mathematics, physics, pure chemistry, pure geology, zoology, psychology and botany, so it was really a Congress of American Republics, neither Pan-American nor scientific. The United States Secretary of the Navy, in selecting the societies to elect members of the Naval Advisory Board, ignored the National Academy of Science, which is by law the advisor of the Government, and also ignored the American Association for the Advancement of Science, which is the great democratic body of over 4,000 scientific men of the United States and Canada. He apparently never heard of either association. These striking examples seem sufficient to suggest that the forestry branch of science, as well as the whole tree, would do well to seek aid by every means of publicity, recreation, entertainment, education and research possible. Since all these means are included among museum methods and in the work of up-to-date museums, museums may become of great aid to forestry, while forestry may provide museums with many necessary scientific facts.

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THE GENERA OF THE ODONTOPLEURIDAE.

By Percy E. Raymond.

Odontopleura (*Acidaspis* auct.) is essentially a Bohemian genus, as may be seen if one contrasts the 40 species listed by Barrande with the 2 species of Esthonia, the 12 or 15 species of Scandinavia, and the same number in Great Britain.

Practically the only attempt at a subdivision of the Odontopleuridae is that of Dr. John M. Clarke.* He recognized six subgenera of the genus *Ceratocephala*, viz., *Ceratocephala* s. s., *Acidaspis*, *Odontopleura*, *Dicranurus*, *Selenopeltis* and *Ancyropyge*. I adopted this classification in the second edition of the Eastman-Zittel text book (1913), raising the subgenera to generic rank, and grouping them under Burmeister's family name Odontopleuridae. Recently I have had occasion to study the very large collection of trilobites of this family in the Museum of Comparative Zoology, and while I have been able to continue the use of the names listed above, I find that the definitions and limits of the genera *Odontopleura*, *Ceratocephala* and *Acidaspis* must be very considerably modified.

Dr. Clarke's definitions of the three genera were as follows: *Odontopleura*, occipital ring smooth or with a central tubercle; *Acidaspis*, occipital ring with a single straight median spine; *Ceratocephala*, occipital ring with two straight divergent spines. This scheme was, of course, simplicity itself, and, so long as applied to the American species alone, seemed to work very well. If, however, one turns to plate 38 of Barrande's "Système Silurien du Centre de la Bohême," and looks at the three figures (22, 25 and 30) at the bottom of the plate, he sees at once that this classification is not a natural one. The figures represent *Acidaspis dormitzeri* Hawle and Corda, *A. dufrenoyi* Barrande, both from the Silurian, and *A. hoernesi* Barrande, from the Lower Devonian of Bohemia. In glabella, free cheeks, thorax and pygidium, these species are exceedingly alike, yet the first has a neck tubercle, so would be called *Odontopleura*, the second has two long neck spines, and would be a *Ceratocephala*, while the third has a single long neck spine, and would have to be called *Acidaspis*. Except for these spines, the species show no important differences, and it is evident that in any natural classification they would be congeneric. Compared with the type-species of *Ceratocephala* and *Acidaspis*, *Acidaspis dufrenoyi* and *A. hoernesi* show marked differences in all parts except in the spines on the occipital ring.

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*Notes on the Genus Acidaspis. 10th Rept. N.Y. State Geologist, 1891, p. 61.

Ceratocephala, Warder, Am. Jour. Sci. 34, 1838, p. 377. Type, *C. goniata*, ibidem, p. 378, fig. The typical species was badly described and figured by Warder, but all parts are now known. Among the striking features of this trilobite one may note the coalescence of the free and fixed cheeks, accompanied by the obliteration of the facial suture, the almost complete obliteration of the dorsal furrows on the cephalon, and the position of the eyes, far from the glabella, and half way to the front of the cephalon. On the thorax the horizontal furrow on the pleural lobe of each segment is weak, and the two low ridges separated by this furrow are equal. The pygidium has long subequal barbed spines.

Acidaspis, Murchison. Silurian System, 1839, p. 658. Type, *A. brighti* Murchison, ibidem, pl. 14, fig. 15. The glabella of the typical species is roughly triangular in outline, tapering rapidly forward. The eyes are situated far back and close to the glabella, and the whole neck ring is prolonged backward into a long heavy spine. No more than the cephalon of the typical species is definitely known. In the American *A. anchoralis* and *A. oñealli*, which have the same sort of a cephalon, the thoracic segments are narrow, and the linear horizontal furrow separates a high narrow posterior ridge from a low narrow anterior one on the pleural portion of each segment. In these same species, the pygidium has two long lateral spines, between which are short spines, and outside of which are small spines. A similar pygidium has been referred to *A. brighti*.

Odontopleura, Emmrich. De Trilobitis, 1839, p. 53. Type, *O. ovata* Emmrich, ibidem, pl. fig. 3. The type, an entire specimen, is characterized by its broad form, an oval glabella which does not taper much toward the front, and the central position of the elevated ridge on the pleural lobe of each thoracic segment. The pygidium is not unlike that ascribed to *Acidaspis*, except that the spines are more nearly equal in size.

As one looks over the various Odontopleuridae which have been described, it is seen that there are a few which agree with the type of *Ceratocephala* in having the fixed and free cheeks in symphysis, eyes well forward, and pleura of thoracic segments without a pronounced ridge; there are also a few which agree with the type of *Acidaspis* in having a triangular glabella and a broad stout nucal spine; a few others which have the characteristics of *Dicranurus*, *Selenopeltis*, or *Ancyropyge*, but the great majority have an oval glabella and a prominent median ridge on the pleural portion of each thoracic segment, as in *Odontopleura*. Hence, the name given to the family by Burmeister is not only the oldest, but is particularly appropriate.

It is quite possible that the species which I have grouped under *Odontopleura* can and will be arranged in other subgenera or genera. The type is a very broad form, and a row of tubercles on each of the thoracic segments is a prominent feature of the ornamentation. With it could be associated *O. prevosti* Barrande, and *O. hughsi* (Salter). Another group, with a narrower form, fewer tubercles on the thorax, and fewer and longer spines on the pygidium, is exemplified by *O. dufrenoyi*, *O. hoernesi*, *O. roemeri*, and other Bohemian species. A third group, with thick, subequal pygidial spines, would include *O. pectinifera* Barrande, and *O. cornuta* (Salter). Then there is the exceedingly spinose *O. mira* Barrande, with very numerous and small pygidial spines, barbed lateral thoracic spines, and very tall eyes. For the present, however, it seems useless to break up the genus into such small groups.

To replace my definitions in the Zittel-Eastman text book, I would suggest the outline of the family which follows:—

FAMILY ODONTOPLEURIDAE BURMEISTER.

Opisthoparia with large free cheeks and eyes (usually), far back and close to the glabella. Lateral lobes of the glabella reduced to two or one. Thorax of 8 to 11 segments. All parts of the test usually very spinose, the spines usually of the horizontal type.

Odontopleura, Emmrich. Glabella oval in outline. The pleural lobe of each segment of the thorax has a narrow, strongly elevated median ridge. Ordovician to Devonian. Cosmopolitan.

Acidaspis, Murchison. Glabella roughly triangular in outline, tapering towards the front. The pleural lobe of each segment is divided by a linear furrow into a low anterior and an elevated posterior ridge. Ordovician and Silurian. Europe and North America.

Ceratocephala, Warder. Free and fixed cheeks anchylosed, eyes far forward and far from the glabella. The pleural lobe of each thoracic segment is divided by a shallow median furrow into equally elevated portions. Silurian, Europe and North America.

Dicranurus, Conrad. Dorsal furrows weak on cephalon, but the free and fixed cheeks not anchylosed. Occipital ring with two very long spirally curved spines. Pygidium with only a single pair of spines. Lower Devonian, Europe and North America.

Ancyropyge, Clarke. Margin of pygidium with 12 very long slender curved spines. Devonian, North America.

Selenopeltis, Hawle and Corda. Eyes half way to the front of the cephalon. The pleural lobe of each thoracic segment is crossed diagonally by a ridge which is extended into a very long spine. Pygidium with only a single pair of spines. Ordovician, Bohemia.

Glaphurus, Raymond. Probably does not belong to the Odontopleuridae.

NOTE ON DICRANURUS.

The *Dicranurus monstrosus* (Barrande) of Bohemia is exceedingly like our *D. hamatus* Conrad, of New York. The collection in the Museum of Comparative Zoology contains many fine specimens of the Bohemian form, including the originals of figures 1-3, plate 15, of the supplement to volume 1 of the "Silurian System." The original of figure 3 is an indeterminable fragment, but certainly has nothing to do with the pygidium of this species. The pygidium was unknown to Barrande, but our collection contains an example from Lochkow, where the species seems to be rather common. It is of the same type as that described by Barrande as *Acidaspis spoliata* (Suppl. 1872, p. 82, pl. 14, fig. 46). The type of this latter species is from Mnienian, Bohemia, and it also is in the Museum of Comparative Zoology. The pygidium is short, triangular, and there are two strong spines which arise from the upper surface of the test, and not from the margin. The spines arise in the same way in *Selenopeltis*, the spines in that genus being of considerable length, but seldom preserved, even on excellent specimens. It is interesting that the oldest genus (*Selenopeltis*), and the youngest (*Dicranurus*), of the Odontopleuridae, should both have a pygidium with an aspinose margin, while the other members of the family all have numerous spines on the pygidium.

AMERICAN SPECIES.

In the following list I have attempted to arrange the American species in accordance with the above definitions. It is not necessary to give references to the place of publication of the Ordovician and Silurian species, since they may readily be found in Bassler's recent and exceedingly valuable "Index of American Ordovician and Silurian Fossils."* In cases where I have had to change the name, I have added in brackets the name under which it is to be found in Bassler's catalogue: —

Ancyropyge romingeri (Hall), Pal., N.Y., vol. 7.
Acidaspis anchoralis Miller (*Ceratocephala*).
A. ceralepta (Anthony) (*Ceratocephala*).
A. cincinnatiensis Meek (*Ceratocephala*).
A. crosota (Locke) (*Odontopleura*).
A. obsoleta Van Ingen.
A. onealli Miller (*Odontopleura*).
A. parvula Walcott (*Odontopleura*).
A. quinquispinosa Lake.
A. trentonensis Hall (*Odontopleura*).
A. vanhorni Weller.
Ceratocephala depauperata Van Ingen.
C. goniata Warder.
Dicranurus hamatus Conrad. Pal., N.Y., vol. 3.
Odontopleura arkansana Van Ingen.
O. callicera (Hall).
O. coalescens (Van Ingen) (*Ceratocephala*).
O. halli (Shumard).
O. horani (Billings) (*Ceratocephala*).
O. illinoisensis Weller.
O. narrawayi Raymond (*Ceratocephala*).
O. nodulata (Van Ingen) (*Ceratocephala*).
O. ortoni (Foerste).
O. perarmata (Whiteaves) (*Acidaspis*).
O. robina (Clarke). Mem. N. Y. State Mus. Memoir 9.
O? brevispinosa (Foerste)† (*Acidaspis*).
O? fimbriata (Hall)† (*Ceratocephala*).

Museum of Comparative Zoology,
Cambridge, Mass.

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*Bull. U.S. National Museum, 92, 1915.
†Not adequately described.

PRENANTHES MAINENSIS:

NOTES ON THE MORPHOLOGY, TAXONOMY AND DISTRIBUTION OF THIS HYBRID FORM.

By BRO. M. VICTORIN, Longueuil College, Longueuil, Que .

Up to the present time very little attention has been devoted in this country to the study of natural hybrids. The subject, however, is of the utmost importance, not only to students of Mendelism, but also to the average systematist. "In fact," says De Vries, "the majority of authors agree that systematic and sexual affinity are essentially parallel, as they are really no more than two manifestations of one and the same thing; but we have not yet succeeded in explaining the apparent exceptions to this parallel." (*) If some light is ever to be thrown on the subject, it will doubtless be through observations on natural hybrids, in widely separated groups of the plant kingdom.

We have in a previous paper (†) studied quite extensively a cross of two distant species of *Lysimachia* : *L. terrestris* (L.) B.S.P. x *L. thyrsiflora* L., and hinted that the recently proposed genus *Naumburgia*, created to account for *L. thyrsiflora*, was not founded in nature, since the plant hybridizes freely with other *Lysimachia* species. The writer knows such hybrid to occur constantly in Chateauguy, Que., and Professor M. L. Fernald, of the Gray Herbarium, states that he has collected it in Maine, and also in Prince Edward Island.

The present paper will deal with another interesting hybrid in the genus *Prenanthes* (Compositæ), which is of rare occurrence and has never received close study.

In a detailed botanical survey conducted during the summers of 1913 and 1914 along the coastal portion of the county of Temiscouata, Que., our attention was called to various forms of *Prenanthes* growing intermingled in a salt marsh at Anse à Persi, near Rivière-du-Loup. Specimens were collected and a preliminary study showed the bulk of the crop to be typical but stunted *P. trifoliata* and *P. racemosa*, whilst the rest appeared somewhat puzzling and intermediate between the two. We determined to prepare a large series of specimens to facilitate a thorough study, but, alas! the next morning the marsh was found neatly mowed, and the *Prenanthes* were no more.

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*Hugo de Vries, "Mutation Theory," II., 593-599 (English translation).

†Fr. Marie Victorin, "Notes sur Deux Cas d'Hybridisma Naturel." Nat. Can. XXXIX., 177-189.

Later study and comparison with type in the Gray Herbarium have shown our doubtful forms to be equivalent to *P. mainensis* Gray. There can be hardly any doubt now that the so-called *P. mainensis* is a natural hybrid: *P. racemosa* x *P. trifoliata*. Gray's text reads as follows: "About two feet high, leafy up and into the panicle; leaves nearly those of *P. racemosa*, but thinner and less glaucous; the radical ovate, commonly with abrupt or rounded base; upper, subtending clusters of the interrupted narrow thrysus; heads all drooping both before and after anthesis, resembling those of the following species (*P. virgata* Michx). Shore of the St. John's River at St. Francis, North Maine, *Pringle*. Growing with or near *P. racemosa*. And a looser form of the latter, "very common on the St. John's River," (*Goodale*) is somewhat between the two; so that this may be a hybrid between *P. racemosa* and *P. serpentaria*."(*)

It should be borne in mind that when these lines were written (1886), *P. trifoliata* had not yet been separated from *P. serpentaria*. From the description of Gray it appears that the plant named by him *P. mainensis* was an extreme form of the hybrid, differing from the "looser form of *P. racemosa*" only quantitatively, and that both are but distant terms of a Mendelian series.

We will now give the result of our own study based on the comparison of 15 specimens of *P. racemosa*, 20 of *P. trifoliata*, and 8 of *P. mainensis*.

STEM.

An important reduction in size is first noticeable, which is doubtless a response to the semi-halophytic habitat. In normal conditions *P. racemosa* reaches fully 2m., whilst here its maximum is 30cm. *P. trifoliata* generally grows to a height of 1.50m., and exceptionally to 3m.; in this locality no specimen higher than 32cm. was found.

It is well known to breeders, as well as to students in hybridism, that crosses between nearly related forms are more vigorous than either parent. The following tabulation will emphasize the law as applied to the present case:—

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*Gray, Asa, " Synoptical Flora," I., 433, 1886.

COMPARED SIZE OF
P. racemosa, P. trifoliata, P. mainensis.

Height in cm.	RACEMOSA		TRIFOLIATA		MAINENSIS	
	Number	Product	Number	Product	Number	Product
15	2	30	. .	. .	. .	. .
16	. .	. .	. .	. .	. .	. .
17	2	34	2	34	. .	. .
18	2	36		.	. .	. .
19	2	38	2	38	. .	. .
20	. .		4	80	. .	. .
21	2	42	1	21	. .	.
22	. .		1	22	. .	. .
23	.	.	4	92	. .	. .
24	3	72	1	24	. .	. .
25		.		.	. .	. .
26	. .		2	52	. .	. .
27	1	27	. .	. .	1	27
28		.	1	28	. .	. .
29	. .	.	1	29	1	29
30	1	30		. .	. .	. .
31	.	. .	. .	.	. .	. .
32	.		1	32	1	32
33	.	. .		.	. .	. .
34	.		.	. .	. .	. .
35	. .	. .	.	. .	. .	. .
36	.	.	. .	.	1	36
37	. .	.	.	.	. .	. .
38	. .	.	. .	. .	1	38
39	. .	. .	.	.	1	39
40	. .	. .	. .	. .	. .	. .
41	. .	. .	. .	. .	2	82
Total......	15	309	20	452	8	283
Mean......	20.6 cm.		22.6 cm.		35.3 cm.	

The series of specimens is not numerous enough to show very clearly a curve of Quetelet, but what stands prominently is the fact that *P. mainensis*, the hybrid, is taller by 63 per cent. than the parent species (figuring on the means). What are the causes of this increased luxuriance? They are yet a matter of research. Tischler and Jost (*) agree that it is probably due to a "poisoning" effect of one species on the other.

LEAVES.

We have not been able to see the radical leaves of *P. mainensis* of which Gray makes so much in the above-mentioned description, but we observe that the lowest stem leaves taper into a winged petiole which sometimes reaches 10 cm. Most re-

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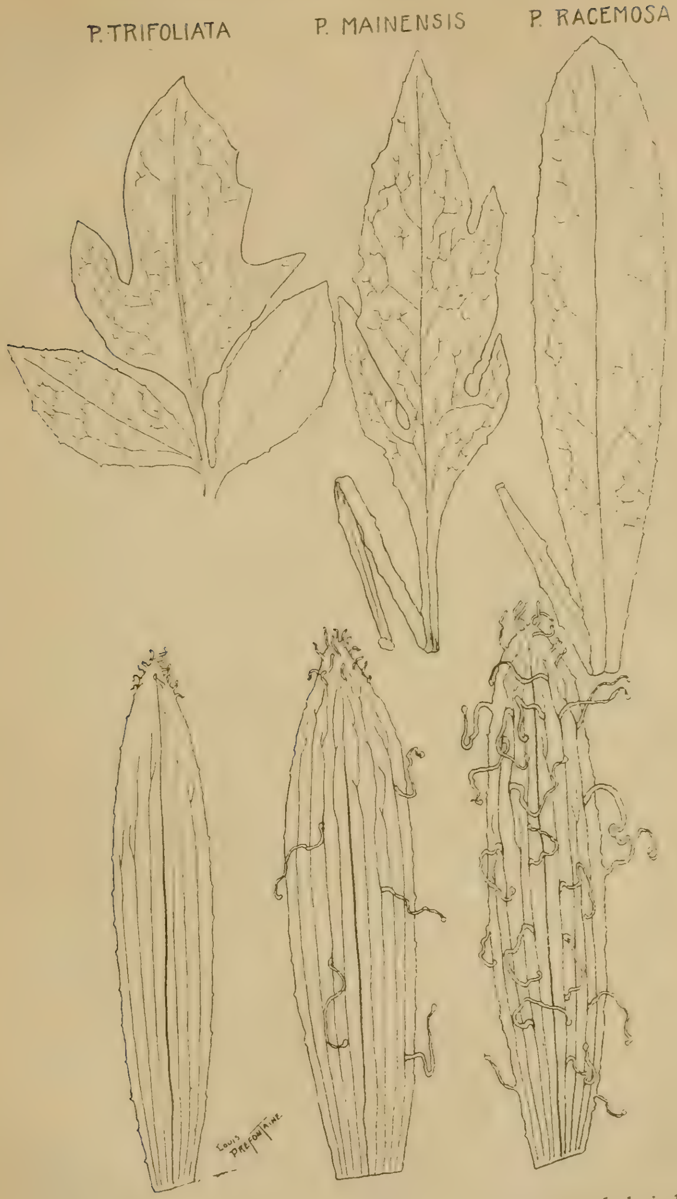
*"Arch. Zellsforchung," I., 33-151, 1908.


P. TRIFOLIATA
P. MAINENSIS
P. RACEMOSA
LOUIS PREFONTAINE

Leaves and bracts of *Prenanthes trifoliata*, *P. racemosa* and their hybrid *P. mainensis*. Bracts much enlarged.

markable is the tendency some of the leaves exhibit to lobate after the manner of *P. trifoliata.* But this tendency is checked in some way in its action, as it succeeds in affecting only one-half of the leaf, thus showing that the elementary characters of *P. racemosa* are dominant over those of *P. trifoliata.*

In the three plants the leaves are bordered with glandular teeth.

Flower and Fruit.

The color of the ray-flowers of *P. mainensis* is evidently intermediate between the pale purple of *P. racemosa* and the straw yellow of *P. trifoliata.*

The inner bracts of the involucre are about the same in outline in the three plants, but they differ much in the amount of pubescence. In *P. trifoliata* these bracts are perfectly glabrous; in *P. racemosa* they are covered with very long ribbon-like flattened hair tipped with a spherical gland; *P. mainensis* shows a pubescence much like that of *P. racemosa*, but very scarce, the evident result of the fusing of opposed characters.

The bract of *P. mainensis* ends in a somewhat fimbriate obtuse point bearing septate hair, very different from those described above; they are much shorter, and consist in a single line of hyaline cells. The bracts of *P. trifoliata* and *P. racemosa* show the same peculiarity.

The bracts of *P. racemosa* and *P. mainensis* are covered with truncate conical papillae, inclined towards the point of the bract. Every cell being papilla-bearing, their number can be estimated in round figures to 10,000 per sq. mm. None of the twenty specimens of *P. trifoliata* from the halophytic habitat of Anse à Persi showed these papillae, but we found them in smaller numbers, and different in form, on a giant specimen collected on the quartzite rocks of the "Gros Pelerin," one of the islands off the Kamouraska coast.

The akene of *P. mainensis* is slightly longer than that of *P. racemosa*, and much longer than that of *P. trifoliata*, even when giant specimens of the latter are considered.

Distribution.

We do not believe that *P. mainensis* has been before noted outside of the type station on the St. John's River, neither do we think it can be found frequently on account of the distribution of the parent species and their different habitat.

P. racemosa is very widely distributed in North America, from Eastern Quebec to Alberta, whilst *P. trifoliata* is distinctly eastern and boreal. In the Province of Quebec there is no sure record west of "Gros Pelerin" island, though some of Macoun's localities under *P. serpentaria* may belong here. The distribution of *P. trifoliata* is therefore restrictive as regards the possible occurrence of *P. mainensis*.

Moreover, *P. racemosa* is a riverside and prairie species, and *P. trifoliata* a plant with xerophytic preferences, so that the two are rarely to be met together, except in such habitat as the halophytic, or more exactly the semi-halophytic, where water is to be found, but which at the same time is physiologically dry.

BIRDS OF ALGONQUIN PARK.*

By W. E. Saunders, London, Ont.

On August 11th, 1915, Mr. E. M. S. Dale and the writer started from Joe Lake on an investigation of the birds and mammals, chiefly the former, of Algonquin Park. It is probably unnecessary to give any description of the character of the country, in which spruce, pine, poplar and birch alternate, as is usual in the northern parts of Ontario.

The fauna of this region should be more northern than would be called for by latitude only, because of the altitude, which is nearly two thousand feet.

After packing our dunnage in bags and loading it into the canoe, we got away to a favorable start. During the first day we saw nothing of moment until we reached Island Lake, where our ears were assailed by the calling of two hawks, which proved to be Goshawks. Their calls were of rather a peculiar character. They were in descending thirds, as is the case with the Marsh Hawk, and more particularly the Sharpshin, but they had two different calls. In one the phrases were repeated about every second and a half, and in the other, which was about half an octave higher, they were repeated about four times each second. We paddled over near where they were sitting in some dead timber, and one of them flew over us with a scissor-tail effect, opening and shutting the tail.

The first night's trapping for mice yielded nothing but one *Sorex personatus* and several of the northern deer mice. While passing over the portage and through the Otter Slide lakes it rained so hard that we sought shelter at the point where the creek leaves for White Trout lake, and spent the night in a tumbledown lumberman's building. Next morning we had a call from an Olive-sided Flycatcher, of which we met a good many on the trip. They were not using their whistling call but the *Ku-Ku-Ku* which some of them repeated endlessly; in fact there were two which we concluded must have made a bet as to which could say it the most times in a day, and one of them stuck to it almost all day. Being an exceedingly monotonous note, we both felt that we got very well acquainted with it indeed, and should not forget it in a hurry. At this point we saw the only solitary Sandpiper on the trip. It was rather a surprise not to see more of these birds, as a great deal of the country is well suited to them. The trip down the stream into White Trout lake provided rather more walking than we appreciated, as the portages were long and somewhat arduous, but we met here our first Ruffed Grouse, Black-backed Woodpecker, and Duck Hawk, the latter flying high overhead while we were on one of the portages right opposite a high cliff, which, however, did not look very suitable for nesting on account of recent devastation by fire.

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*Read at the December meeting of the McIlwraith Ornithological Club.

On these portages we found numerous runs of field mice, and subsequent trapping succeeded in getting a couple of them. They seemed rather too reddish to be our southern form, but this has not yet been definitely determined. The creek is wide and well filled with stumps and grass for the last half mile before it enters into the lake, and the banks are covered with dead and dying timber, which made a very attractive spot for woodpeckers. Here we became very well acquainted with a good many notes of the Black-backed Woodpecker. Once or twice we heard some genuine Blackbird notes from a Rusty at this point, but all the rest of the notes of that character were from the woodpecker. Here, also, we met our first Canada Jay or Whiskey Jack, a pair of which came flying down to interview us at the end of one of the portages. We tried to make friends with them, but they were not to be cajoled, and the bread which we laid on top of a burnt stump remained there untouched. As usual they were very quiet, but later on we heard from them quite a variety of notes, mostly of a very liquid character, and for the writer, not very easily described. Their flight resembles that of the Blue Jay to a considerabe extent, but there were differences which would make them readily identifiable by one who was well acquainted.

Paddling around the left corner of the entrance into the White Trout lake we found the most beautiful camp of the trip in a sandy bay which made excellent bathing. The level of the woods was only about ten feet above the lake, and a beautiful location was all ready for our tent, with a sun parlor overlooking the bay. Here we stayed for two nights while we trapped on the last portage and explored the nearby islands.

which contained nothing of very great interest. Our next stop was at the northern end of White Trout lake, where we slept in the shelter hut on the portage into Longer lake. The traps were set on a small island which had been burnt over about ten years before, and now contains a beautiful stand of young red pine five to ten feet high. We were interested to investigate the mammal inhabitants of this little islet, and found, as we expected, that nothing was on it excepting deer mice, and very few of them, both the cover and the food having been burnt off by the fire, and replacement not having progressed to any great extent.

The ranger who was located at this portage had a boy who was somewhat interested in the trapping industry, and wanted not only to catch some mice for himself but to see how they were prepared, and we spent an evening in the house illustrating the operation. The boy had set a trap which we gave him, on top of a cupboard in the one room of the house, and twice during the evening the trap was sprung and each time caught a deer mouse, in spite of the fact that the room was lit and contained five people, who were making no effort to be quiet.

A short exploration of Longer lake and one of the beaver streams leading into it completed this end of our trip. From the middle of the lake we saw a fine nest of the Osprey, located some four or five hundred yards back from the shore. It was exceedingly conspicuous, being placed, as usual, high up in a dead tree. Retracing our steps to White Trout lake we spent another evening in the shelter hut, and in the early morning, while preparing breakfast, the writer had a call from a beautiful large skunk which was not at all aggressive, but rather timid, and immediately retreated on being discovered. These animals are said to be very common in the park.

Launching again on White Trout lake, we turned our bow towards the north-west corner, and paddling through the narrows, went down through Grassy bay to the mouth of the Petewawa river.

Here there is a good deal of shallow water and some grass showing through it. There was an attractive point which overlooked the bay from quite a nice elevation. Here we landed and stayed some time, the most interesting part of which was spent in admiring the antics of three otters which came to the surface about a hundred yards away, and were at first taken for beaver, but the style of swimming with the head elevated, as is the habit of a mink, not held level on the water as is the habit of the beaver and muskrat, at once identified them. As this animal was a new acquaintance for both of us we watched with great interest their movements. When swimming underneath the water they had a most interesting habit of following each other on every little deviation. When one would come to the surface, breathe and go down, the one immediately after did the same thing at the same place, and then the third following; they soon went into the grasses where they were not clearly visible, but they began working towards a little opening near us in which sat a Pied Bill Grebe. She kept a watchful eye on the motions of the otters, and when they were within twenty or thirty yards, disappeared and re-appeared some thirty yards to one side, and it happened that they did not go any nearer to her. They soon caught some fish and, fortunately for us, there were some stranded stumps and roots on which they climbed out and ate their catch. They also played with each other, and quarreled in a friendly way, which led us to suppose that they were young, or at most a mother and two young, though we could see no difference in their size.

This was perhaps the rarest sight of our trip, and we were exceedingly gratified that it lasted nearly an hour.

We then proceeded up McIntosh creek as far as the first portage, where we decided to retrace our steps. We followed the portage trail up through the woods, and had the pleasure of seeing there our only pair of the Pileated woodpecker. They were not very tame, and gave us little opportunity for observation, but it was a joy to see these big birds again. They are said to be quite common in some parts of the park. Two boys from Toronto camping on Lake LaMuir told us that they were frequently seen near their camp. A ranger with whom we talked told us that they inhabited the big timber only, which means the districts where the pine has not been cut off, and it was in a region of large trees that these two birds were seen.

Next morning we began our return trip through White Trout lake.

After paddling two or three miles we came to the high bluff facing the lumber camp on the north side of the lake, where we had climbed on the preceding day hunting for ferns. This time we found something much better than the ferns, in the person of a Duck Hawk, which gave us one of the most beautiful illustrations of sailing with motionless wings that either of us had ever seen. Evidently he was keeping watch over something, and as the location was entirely suited to their needs as a nesting place, we thought it not improbable that the young were nearby. After we had passed the cliff we heard him scream, and looking back found that he had been joined by his mate, but we gathered no more information regarding their habits or location.

When lunch time arrived we landed on an island separated by a narrow stretch of water from the shore, and while we were busily engaged, a large, black, hawk-like bird came sailing up the narrow channel, and was promptly identified as a Raven. He rose over the banks on the other side, and while passing gave out two or three of his characteristic notes. He was followed by two others, which did not come quite as far before turning, but still gave us a fair view of their flight.

There are times when a Raven and a Crow might puzzle an observer, but when flying they can be easily identified; the flight of the larger bird is very hawk-like and entirely different from that of the crow.

No other rarity was noted until we had passed up the five portages to Otter Slide lake again, where we camped at the entrance of the stream. Here we were in great luck in choosing the very spot used by the local troop of warblers as one of their promenades.

While setting traps across the stream that evening we heard, but failed to find, a Hudsonian Chickadee. Next morning he passed with the Warblers, Chickadees, Nuthatches, etc., over the route right around our camp, but succeeded in getting by without giving us a chance to see him; but before we left that camp the warblers passed us again, and this time the Hudsonian came out in the open and settled in the top of a little balsam tree close by, giving us every opportunity for examination. From this camp also we heard the Barred Owl, thanks to the sleeplessness of my companion. The bird was at a considerable distance, but his notes were unmistakably not those of the Great Horned Owl.

During the first night's camp at this spot our slumbers were interrupted by a Porcupine, which was apparently eating up the canoe. An expedition in undress uniform was made to scare him away, but he was sitting out in the far end of the canoe and was not inclined to be interrupted, and when we spoke to him he chattered his teeth as if in defiance, and it was not until we hit him with a little stick that he ran down the length of the canoe at a surprising speed and disappeared in the woods. These animals are tolerably common, but are easy victims to the destructive instincts present in many persons, and we found the remains of one that had been recently and uselessly killed on Otter Slide lake. Even the rangers are said to kill this animal, although it is not only against the law, but it is indefensible destruction, as the worst harm that can be charged against the Porcupine is that he injures a few trees during the winter, and if the damage done were calculated on a basis of a percentage value of the standing timber, it would be so small as to be almost invisible. It seems a pity that the rangers cannot be imbued with the spirit of protection which ought to be one of the great features of such a reserve as this park.

Many persons who visit the northern woods complain of the small number of birds seen, and the limited number of species, but the truth seems to be that their faculties have not been trained to observe the birds under altered conditions. On this trip we noted never less than 35 species each day, and the smallest number of individuals was 160, while for the whole trip we saw exactly 90 species. And when it is remembered that the song season was over and most of these birds had to be seen to be recognized, ninety is not such a small number for a short two weeks trip.

Coming from a region where rock ferns have no existence, we were both much interested in meeting a number of unaccustomed species, and besides the Common Polypody, we brought home roots of *Dicksonia*, *Woodsia ilvensis* and *Aspidium noveboracense*, which, though it is not strictly a rock fern, appeared in large clumps in some of the deeper woods. A few other plants which were unusual or unknown to us were *Hieracium aurantiacum* and *Trillium erythrocarpum*. A gentleman from Toronto whose acquaintance we made in the park told us this was *Trillium cernuum*, but reference to Gray's Manual shows that our surmise was correct, and it is *erythrocarpum*, the proof being in the long, attenuated points of the leaves.

The last day was spent in walking along the railway track for the sake of possible additions to our bird list, as there were a number of common species, such as the Crow, Vesper and Chipping sparrows which we did not see when canoeing.

We heard from Ranger Robinson of the occurrence of Spruce Partridge near Joe Lake station, and made a little walk through the region indicated, but without success.

It seemed strange that on the return journey we should meet a brother botanist at the station at Scotia Junction, in the person of Mr. Stevenson of Oshawa, who had been devoting special attention to the ferns, and was just then making a journey with the hope of finding the *Dicksonia*, of which we had seen such beautiful patches.

This little trip into the park left us filled with the desire to visit it again in the springtime, when all these interesting northern species would be nesting, and we could enjoy and study their songs and their home life. The songs of the Thrushes alone would probably repay any interested person for the time spent.

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DATA ON SEED MATURITY OF SOME ONTARIO PLANTS.

By W. Herriot, Galt, Ont.

During the seasons from 1909 to 1914, the writer collected extensively the seeds of many native and naturalized plants, in the vicinity of Galt, Ont., for the Seed Branch at Ottawa.

While our standard works on botany usually give the month of flowering of most plants, and many published lists of local floras give exact dates of flowering, very little has been published as to the time of the maturing of the seed.

Having accumulated considerable data on this point, the list published here may prove of some value; the dates given for flowering are when the plants are well into bloom, and in early flowering plants this may vary considerably in different years, according to weather conditions in spring. The dates given for seed maturing are when seed was collected, and where plants ripen and shed their seed during a short period, as in *Claytonia*, the dates can be taken to represent fairly well the fruiting season. In some few instances where the seed is persistent after maturity, as in *Rumex*, the date of collecting may be some little time after maturity, and, therefore, not so accurate. Again, the dates of flowering and of seed maturity in many cases were not taken during the same year, but, as before mentioned, except in early flowering species the time of flowering from year to year is fairly constant:—

NAME	Time of Flowering	Seed Mature
Sparganium diversifolium Graebner.......	Jul 15	Sep 23
Scheuchzeria palustris L.................	Jun 8	Sep 4
Sagittaria arifolia Nutt..................	Jul 27	Sep 9
Alisma Plantago-aquatica L..............	Aug 14	Sep 7
Andropogon scoparius Michx.............	Aug 7	Sep 17

NAME	Time of Flowering	Seed Mature
Andropogon furcatus Muhl.	Aug 25	Sep 19
Sorghastrum nutans (L.) Nash	Aug 25	Sep 17
Digitaria humifusa Pers.	Aug 17	Sep 21
Digitaria sanguinalis (L.) Scop.	Sep 1	Oct 2
Panicum linearifolium Scribn.	Jul 6	Jul 23
Panicum latifolium L.	Jun 28	Jul 20
Leersia oryzoides (L.) Sw.	Aug 5	Sep 18
Millium effusum L.	Jun 3	Jun 17
Oryzopsis asperifolia Michx.	Apr 23	Jun 10
Muhlenbergia mexicana (L.) Trin.	Sep 6	Oct 15
Brachyelytrum erectum (Shreb.) Beauv.	Jun 28	Jul 29
Alopecurus geniculatus L. var. aristulatus Torr.	Jun 14	Jul 11
Cinna latifolia (Trev.) Griseb.	Aug 1	Aug 26
Sphenopholis pallens (Spreng.) Scribn.	Jul 6	Jul 20
Deschampsia caespitosa (L.) Beauv.	Jun 16	Jul 2
Avena sterilis L.	Jul 26	Aug 12
Danthonia spicata (L.) Beauv.	Jul 1	Jul 19
Spartina Michauxiana Hitchc.	Aug 1	Sep 17
Poa anuua L.	Apr 30	Jun 3
Poa triflora Gilib.	Jul 9	Jul 29
Poa debilis Torr.	May 28	Jun 16
Poa alsodes Gray	Jun 1	Jun 16
Glyceria canadensis (Michx.) Trin.	Jul 6	Aug 8
Glyceria nervata (Willd.) Trin.	Jun 3	Jun 27
Glyceria grandis Wats.	Jun 29	Jul 19
Glyceria septentrionalis Hitchc.	Jun 14	Jul 9
Puccinellia distans (L). Parl.	Jun 23	Jul 8
Festuca nutans Spreng.	Jul 1	Jul 13
Melica striata (Michx.) Hitchc.	Jun 21	Jul 13
Bromus tectorum L.	Jun 13	Jul 13
Bromus Kalmii Gray	Aug 25	Sep 4
Agropyrum repens (L.) Beauv.	Jul 25	Sep 13
Agropyrum caninum (L.) Beauv.	Jul 1	Sep 11
Elymus striatus Willd.	Jul 20	Aug 13
Elymus canadensis L.	Aug 25	Sep 18
Hystrix patula Moench	Jul 13	Sep 4
Cyperus esculentus L.	Aug 18	Oct 30
Eleocharis ovata (Roth.) R. & S.	Jun 15	Jul 21
Scirpus validus Vahl.	Jul 27	Sep 9
Scirpus atrovirens Muhl.	Aug 3	Oct 7
Scirpus cyperinus (L.) Kunth	Jul 31	Oct 1
Rynchospora fusca (L.) Ait. f.	Aug 31	Sep 6
Cladium mariscoides (Muhl.) Torr.	Aug 31	Sep 2
Carex cristata Schwein.	Aug 6	Aug 25

NAME	Time of Flowering	Seed Mature
CAREX BEBBII Olney	Jul 3	Aug 6
CAREX SYCHNOCEPHALA Carey	Jul 30	Aug 26
CAREX SCIRPOIDES Schkuhr	Jun 3	Jun 24
CAREX VULPINOIDEA Michx	Jul 1	Jul 18
CAREX DIANDRA Schrank	Jun 20	Jul 11
CAREX STIPATA Muhl	Jun 4	Jun 21
CAREX STRICTA Lam	Jun 4	Jun 25
CAREX LEPTALEA Wahlenb	Jun 1	Jun 26
CAREX PUBESCENS Muhl	Jun 1	Jun 21
CAREX FLAVA L	May 28	Jul 13
CAREX HYSTERICINA Muhl	Jun 16	Jul 2
CAREX SCHWEINITZII Dewey	Jun 4	Jul 13
CAREX LUPULINA Muhl	Aug 1	Oct 7
CAREX ROSTRATA Stokes	Jun 10	Jul 9
ARISAEMA TRIPHYLLUM (L.) Schott	May 26	Aug 26
CALLA PALUSTRIS L	May 6	Sep 7
SYMPLOCARPUS FOETIDUS (L.) Nutt	Apr 20	Oct 14
JUNCUS TENUIS Willd	Jun 29	Jul 11
JUNCUS EFFUSUS L	Jun 23	Jul 29
JUNCUS CANADENSIS J. Gay	Aug 31	Sep 4
LILIUM SUPERBUM L	Jul 6	Sep 16
CLINTONIA BOREALIS (Ait.) Raf	Jun 3	Jul 22
SMILACINA RACEMOSA (L.) Desf	Jun 15	Sep 16
STREPTOPUS ROSEUS Michx	Jun 3	Jul 22
TRILLIUM GRANDIFLORUM (Michx.) Salisb	May 14	Jun 15
CANNABIS SATIVA L	Aug 23	Sep 25
URTICA GRACILIS Ait	Jul 25	Oct 15
BOEHMERIA CYLINDRICA (L.) SW	Aug 3	Oct 28
RUMEX BRITANNICA L	Jul 26	Sep 7
RUMEX VERTICILLATUS L	Jul 23	Sep 6
RUMEX OBTUSIFOLIUS L	Jul 8	Jul 27
RUMEX ACETOSELLA L	Jun 13	Jul 15
RUMEX CRISPUS L	Jun 27	Jul 15
POLYGONUM PENNSYLVANICUM L	Aug 3	Sep 1
POLYGONUM HYDROPIPER L	Aug 26	Sep 19
POLYGONUM SAGITTATUM L	Aug 6	Aug 23
POLYGONUM AVICULARE L	Sep 1	Oct 14
KOCHIA SCOPARIA (L.) Schrad	Aug 31	Oct 9
SPERGULA ARVENSIS L	Jun 26	Aug 17
ARENARIA SERPYLLIFOLIA L	Jun 1	Jun 28
CERASTIUM VULGATUM L	Jun 4	Jun 22
LYCHNIS ALBA Mill	Jun 5	Sep 19
SILENE LATIFOLIA (Mill.) B. & R	Jun 14	Jul 22
SAPONARIA OFFICINALIS L	Aug 2	Sep 22
CLAYTONIA VIRGINICA L	Apr 9	May 24

NAME	Time of Flowering	Seed Mature
Castalia odorata (Ait.) W. & W.	Jul 9	Aug 6
Ranunculus delphinifolius Torr.	May 7	Jun 18
Ranunculus sceleratus L.	May 24	Jun 21
Ranunculus abortivus L.	May 7	Jun 11
Ranunculus recurvatus Poir.	May 28	Jun 27
Ranunculus fascicularis Muhl.	Apr 16	Jun 11
Ranunculus septentrionalis Poir.	Jun 4	Jul 4
Ranunculus repens L.	May 24	Jul 5
Ranunculus pennsylvanicus L.f.	Jul 9	Aug 6
Thalictrum dioicum L.	Apr 23	Jul 6
Thalictrum polygamum Muhl.	Jul 13	Oct 18
Hepatica triloba Chaix.	Apr 4	Jun 10
Anemone virginiana L.	Jun 14	Sep 11
Caltha palustris L.	May 10	Jun 17
Aquilegia canadensis L.	Jun 1	Jun 24
Actaea rubra (Ait.) Willd.	May 24	Jul 15
Menispermum canadense L.	Jul 6	Sep 23
Podophyllum peltatum L.	Jun 7	Aug 15
Caulophyllum thalictroides (L.) Michx.	Apr 4	Aug 25
Sanguinaria canadensis L.	Apr 9	Jun 25
Chelidonium majus L.	May 21	Jun 28
Papaver Rhoeas L.	Jul 21	Aug 15
Fumaria officinalis L.	Aug 4.	Sep 9
Berteroa incana (L.) DC.	Jul 23	Oct 16
Lepidium apetalum Willd.	Jun 1	Jul 10
Capsella Bursa-pastoris (L.) Medic.	May 24	Jun 17
Camelina microcarpa Andrz.	Jun 3	Jul 7
Brassica alba (L.) Boiss.	Jul 1	Sep 15
Brassica nigra (L.) Koch.	Jul 6	Sep 25
Sisymbrium officinale (L.) Scop.	Jul 9	Aug 31
Radicula Nasturtium-aquaticum(L) B.&B.	Jun 15	Jul 25
Barbarea stricta Andrz.	May 20	Jul 29
Eruca sativa.	Aug 1	Sep 25
Sarracenia purpurea L.	Jun 20	Aug 27
Penthorum sedoides L.	Jul 30	Aug 26
Mitella diphylla L.	May 11	Jun 3
Parnassia caroliniana Michx.	Sep 16	Sep 31
Physocarpus opulifolius (L.) Maxim.	Jul 3	Sep 7
Potentilla recta L.	Jun 18	Aug 6
Potentilla palustris (L.) Scop.	Jul 1	Jul 23
Geum canadense Jacq.	Jun 25	Aug 25
Geum strictum Ait.	Jul 13	Sep 4
Geum rivale L.	Jun 3	Jun 28
Geum triflorum Pursh.	May 24	Jun 25
Agrimonia gryposepala Wallr.	Jul 18	Sep 10

NAME	Time of Flowering	Seed Mature
Gleditsia triacanthos L.	Jun 14	Nov 17
Lupinus perennis L.	Jun 14	Jul 9
Melilotus officinalis (L.) Lam.	Jul 6	Aug 10
Melilotus alba Desr.	Jul 6	Aug 26
Lotus corniculatus L.	Jul 15	Aug 28
Robinia Pseudo-Acacia L.	Jun 20	Nov 23
Desmodium paniculatum (L.) D.C.	Aug 6	Sep 24
Lespedeza frutescens (L.) Britton	Aug 14	Sep 24
Lespedeza capitata Michx.	Aug 24	Oct 26
Geranium maculatum L.	May 28	Jul 1
Polygala Senega L.	Jun 18	Jul 4
Acalypha virginica L.	Aug 25	Oct 1
Euphorbia Cyparissias L.	May 24	Jul 7
Floerkea proserpinacoides Willd.	May 15	Jun 1
Rhus toxicodendron L.	Jun 23	Oct 9
Impatiens fulva Nutt.	Aug 1	Sep 10
Ceanothus americanus L.	Jul 28	Aug 25
Malva rotundifolia L.	Jul 19	Sep 15
Malva moschata L.	Jun 14	Aug 9
Hypericum perforatum L.	Jul 4	Sep 18
Viola arvensis Murr.	May 22	Aug 7
Decodon verticillatus (L.) Ell.	Aug 4	Sep 23
Epilobium angustifolium L.	Aug 1	Aug 26
Oenothera biennis L.	Aug 17	Sep 9
Circaea lutetiana L.	Jul 17	Aug 13
Aralia racemosa L.	Jul 27	Sep 10
Aralia nudicaulis L.	May 28	Jul 23
Panax quinquefolium L.	Jul 1	Sep 5
Sanicula marilandica L.	Jun 16	Sep 4
Sanicula gregaria Bicknell.	Jun 8	Aug 26
Sanicula trifoliata Bicknell.	Jun 19	Aug 13
Osmorhiza Claytoni (Michx.) Clarke	May 28	Jul 25
Osmorhiza longistylis (Torr.) DC.	Jun 10	Jul 25
Conium maculatum L.	Jul 29	Sep 15
Cicuta maculata L.	Jul 25	Sep 20
Carum Carvi L.	Jun 11	Jul 20
Sium cicutæfolium Schrank.	Jul 23	Sep 25
Cryptotaenia canadensis (L.) DC.	Jun 16	Aug 26
Zizia aurea (L.) Koch	Jun 5	Aug 6
Foeniculum vulgare Hill.	Aug 15	Oct 4
Taenidia integerrima (L.) Drude	Jun 14	Aug 12
Aethusa Cynapium L.	Jul 10	Sep 18
Levisticum officinale (L.) Koch	Jul 6	Aug 15
Anethum graveolens L.	Jul 15	Sep 30
Heracleum lanatum Michx.	Jun 27	Sep 11

NAME	Time of Flowering	Seed Mature
Conioselinum chinense (L.) BSP	Aug 31	Sep 24
Angelica atropurpurea L	Jul 8	Jul 25
Daucus Carota L	Aug 6	Sep 17
Kalmia polifolia Wang	Jun 4	Jul 8
Lysimachia vulgaris L	Jul 7	Sep 18
Anagallis arvensis L	Jul 17	Aug 31
Gentiana crinita Froel	Sep 4	Sep 30
Gentiana Andrewsii Griseb	Sep 1	Sep 16
Frasera caroliniensis Walt	Jun 15	Sep 15
Halenia deflexa (Sm.) Griseb	Aug 16	Sep 27
Menyanthes trifoliata L	Jun 2	Jul 14
Asclepias tuberosa L	Jul 13	Oct 7
Asclepias incarnata L	Jul 11	Sep 11
Asclepias syriaca L	Jul 8	Oct 2
Ipomoea purpurea (L.) Roth	Jul 29	Sep 1
Convolvulus sepium L	Jun 27	Oct 2
Cuscuta Gronovii Willd	Aug 23	Sep 16
Hydrophyllum virginianum L	Jun 30	Jul 28
Lapulla virginiana (L.) Greene	Jul 17	Sep 10
Myosotis arvensis (L.) Hill	Jul 16	Aug 17
Verbena urticaefolia L	Aug 3	Sep 18
Verbena hastata L	Jul 11	Sep 18
Marrubium vulgare L	Jul 5	Aug 17
Prunella vulgaris L	Jun 29	Aug 25
Leonurus Cardiaca L	Jul 1	Sep 11
Hyssopus officinalis L	Jul 10	Sep 18
Lycopus virginicus L	Aug 11	Sep 13
Lycopus americanus Muhl	Aug 11	Sep 11
Solanum Dulcamara L	Jun 18	Oct 2
Solanum nigrum L	Sep 2	Oct 1
Physalis heterophylla Nees	Jul 15	Sep 24
Nicandra physaloides (L.) Pers	Sep 5	Sep 21
Hyoscyamus niger L	May 26	Sep 25
Datura Stramonium L	Aug 17	Oct 1
Verbascum Blattaria L	Aug 3	Sep 18
Penstemon hirsutus (L.) Willd	Jun 8	Aug 5
Chelone glabra L	Aug 11	Oct 2
Digitalis purpurea L	Jun 25	Aug 7
Veronica officinalis L	Jun 16	Jul 29
Gerardia virginica (L.) BSP	Aug 6	Sep 24
Gerardia paupercula (Gray) Britton	Jul 25	Sep 30
Pedicularis canadensis L	May 19	Jul 9
Epifagus virginiana (L.) Bart	Aug 27	Oct 6
Phryma Leptostachya L	Jul 21	Sep 9
Plantago lanceolata L	Jul 27	Aug 23

NAME	Time of Flowering	Seed Mature
Galium Aparine L.	May 21	Jul 1
Galium Aparine var. Vaillantii (DC.) Koch.	May 19	Jun 17
Galium circaezans Michx.	Jun 30	Aug 13
Galium trifidum L.	Jun 15	Aug 23
Galium Mollogo L.	Jul 1	Sep 4
Cephalanthus occidentalis L.	Jul 27	Oct 7
Triosteum aurantiacum Bicknell	Jun 8	Sep 2
Dipsacus sylvestris Huds.	Aug 11	Sep 11
Echinocystis lobata (Michx.) T. & G.	Aug 2	Sep 25
Lobelia siphilitica L.	Jul 20	Oct 14
Eupatorium purpureum L.	Aug 2	Sep 17
Eupatorium perfoliatum L.	Aug 11	Oct 15
Solidago squarrosa Muhl.	Aug 27	Oct 15
Solidago juncea Ait.	Aug 23	Oct 22
Solidago graminifolia (L.) Salisb.	Aug 25	Oct 22
Aster macrophyllus L.	Aug 31	Oct 19
Aster novae-angliae L.	Sep 2	Oct 21
Aster multiflorus Ait.	Sep 19	Oct 30
Aster puniceus L.	Aug 31	Oct 21
Inula Helenium L.	Aug 11	Oct 25
Xanthium spinosum L.	Aug 5	Oct 29
Xanthium canadense Mill.	Sep 1	Oct 16
Xanthium echinatum Murr.	Aug 2	Oct 21
Rudbeckia hirta L.	Jul 27	Sep 18
Helianthus stromosus L.	Aug 23	Sep 27
Bidens frondosa L.	Aug 31	Oct 2
Bidens cernua L.	Sep 1	Oct 23
Bidens laevis (L.) BSP.	Aug 31	Oct 15
Anthemis arvensis L.	Jun 10	Jul 26
Tanacetum vulgare L.	Aug 17	Oct 14
Artemisia vulgaris L.	Aug 22	Sep 29
Erechtites hieracifolia (L.) Raf.	Aug 20	Sep 17
Senecio vulgaris L.	Jul 10	Aug 20
Cirsium muticum Michx.	Aug 31	Sep 2
Onopordum Acanthium L.	Aug 23	Oct 9
Centaurea Cyanus L.	Aug 1	Aug 25
Cnicus benedictus L.	Aug 15	Oct 1
Lapsana communis L.	Jul 15	Aug 13
Tragopogon pratensis L.	Jun 4	Jul 15
Lactuca scariola L.	Aug 1	Aug 31

CANADIAN ANTHROPOLOGY AT THE WASHINGTON MEETINGS.

By HARLAN I. SMITH, Geological Survey, Canada.

The 19th International Congress of Americanists met in Washington from December 27th to 31st, 1915, in affiliation with the American Anthropological Association, the American Folk-lore Society, Section I of the "Pan-American Scientific Congress," the American Historical Association, and the Archaeological Institute of America. The meetings were chiefly held in the large auditorium of the United States National Museum, but branch meetings were held in one of the small lecture halls, and one session was held at Georgetown University, followed by a demonstration of Rare Americana and other objects, and a reception under the auspices of the University.

The programme was unusually full, so that it is possible here to refer only to the titles of papers relating to Canada, or on general subjects touching Canadian problems, and to indicate the part taken in the meetings by Canadian representatives.

"The Culture of a Prehistoric Iroquoian Site in Eastern Ontario," was presented by W. J. Wintemberg, of the Geological Survey of Canada.

"Archaeological Work in Northern Nova Scotia," illustrated with slides; and "Remarkable Stone Sculptures from Yale, B.C.," illustrated with slides, were presented by Harlan I. Smith, Geological Survey of Canada.

"The Beaver Indians" were described by Dr. Pliny Earle Goddard, Curator of Ethnology, American Museum of Natural History, New York.

"Early Jesuit Missions in North America" was the subject of a paper by Rev. John O'Conor, F.X., S.J.

"Le verbe dans les adjectives et les adverbs Porteurs" was the title of a paper presented by Father A. G. Morice, O.M.I., St. Boniface, Manitoba.

"The League of the Iroquois" was described by Mr. J. N. B. Hewitt, Bureau of American Ethnology.

"Preliminary Remarks on the Skeletal Material collected by the Jesup Expedition, especially on the Pacific Coast of Canada," were made by Dr. Bruno Oetteking, American Museum of Natural History.

"Terms of Relationship and the Levirate" were discussed by Dr. E. Sapir, Geological Survey of Canada.

"A critique on The Diffusion of Culture," and a paper on "Totemic Complexes in North America," were given by Dr.

A. A. Goldenweiser, Instructor in Anthropology, Columbia University, New York City.

"Chronological Relations of Coastal Algonkin Culture" were discussed by Alanson Skinner, American Museum of Natural History.

"The Huron-Wyandot Clans," and "The Growth of the Tsimshian Phratries," were the subjects given by Mr. C. M. Barbeau, Geological Survey of Canada.

"Herb Medicine Practices of the North-eastern Algonkins" were discussed by Dr. Frank G. Speck, Assistant Professor of Anthropology, University of Pennsylvania.

"Tribes of the Pacific Coast" were described by Dr. A. L. Kroeber, Associate Professor of Anthropology, University of California.

"Cayuga Ownership of New York Land" was the subject of a paper presented by Miss Grace Ellis Taft.

"Recent Developments in the Study of Indian Music" were discussed by Miss Frances Densmore, Special Investigator in Indian Music for the Bureau of American Ethnology.

"Pictures of the Eskimo Culture near Cape Farewell, South Greenland," illustrated with slides, was the title of a paper given by William Thalbitzer, Copenhagen, Denmark.

"Comparative Study of Pawnee and Blackfoot Rituals" was the subject of a paper sent by Dr. Clark Wissler, Curator of Anthropology, American Museum of Natural History.

The Aleutian Language was compared with the Greenlandic by William Thalbitzer, Copenhagen, Denmark.

"Prehistoric Sites in the State of Maine" were described by Warren K. Moorehead, Curator, Department of Archaeology, Phillips Academy.

"La Vinland—sa localisation probable," was the title of a paper read by Alphonse Gagnon, Secretary, Department of Public Works and Labor, Quebec Provincial Government.

"Indications of Visits of White Men to America before Columbus," illustrated with slides, was discussed by William H. Babcock.

Rev. A. G. Morice, O.M.I., St. Boniface, Manitoba, Harlan I. Smith, Geological Survey of Canada, M. Alphonse Gagnon, of Quebec, and Dr. Edward Sapir, Geological Survey of Canada, each acted as secretary for a session of the meetings.

On Wednesday evening a reception was given by the regents and secretary of the Smithsonian Institution to the Congress of Americanists and affiliated societies at the United States National Museum, and on Thursday evening a dinner was tendered to the members of the Congress by the organizing committee and local members of the Congress at the Cosmos Club.

Special exhibits in the United States National Museum had been prepared for the meetings. Twenty-four busts representing distinguished individual Indians, from delegations sent by various tribes to Washington, were exhibited as examples of accurate and permanent records of the normal types of Indians. Another exhibit showed three varieties of artificial skull deformation practised in America. Tattooing was also shown. It will be remembered that both skull deformations and tattooing are found among the Indians of the Pacific Coast of Canada. An archaeological exhibit of economic plants and plant products of prehistoric America was made by W. E. Stafford, Economic Botanist of the United States Department of Agriculture. This included specimens of corn, beans and squash seeds, similar to those found in the archaeological Iroquoian site at Roebuck, Ontario, recently explored by the Geological Survey.

BOOK NOTICE.

FOREST PROTECTION IN CANADA.

The Commission of Conservation has just issued a report on "Forest Protection in Canada, 1913-1914," which is of particular interest. It contains much information respecting the work of the provincial forest services and of the federal departments intrusted with the care of our forests.

Forest fire protection is assuming a large place in public attention. It is obvious that, if Canada is to continue as a wood-producing country, she must conserve her resources of this natural product. The report treats exhaustively of the fire protection of forest lands along railway rights-of-way. Through co-operative action, great headway has been made in securing the reduction of forest losses through fires traceable to railway causes.

The forests of British Columbia and on Dominion lands in the west have been dealt with in reports containing the results of special studies conducted by Dr. C. D. Howe and Mr. J. H. White. The Trent watershed in Ontario has also received especial attention, in a report of an investigation by Dr. C. D. Howe, in the townships of Burleigh and Methuen. This district is important in that, while of very little value as an agricultural area, it is being repeatedly overrun by forest fires, and the little remaining merchantable timber destroyed. It is suggested that the area be placed under the control of the Dominion Forestry Branch for protection from fires and for reforestation.

THE USE OF ORNAMENTAL TREES AND SHRUBS.*

By W. T. Macoun, Dominion Horticulturist.

The extensive forests of Canada are rapidly disappearing through the inroads made upon them by the axe and by fire, but one may yet see some fine woodlands and some magnificent specimens of the stately and attractive trees with which the Dominion is blessed in great variety. These have their economic value, but they have a sentimental and an ornamental value as well, a value which comes from the part they play in a beautiful landscape, either when growing together as in a forest, or when, as individual specimens, their attractive outlines are fully revealed. All who love trees should see to it that our native species are preserved wherever possible, and that areas of natural woodland near our cities and towns should be guarded well.

The value of the delightful and cooling shade of a tree in a hot summer day is not to be measured in dollars and cents. The contrast between a street having attractive shade trees and one without any is very great. Well planted home grounds, with trees and shrubs judiciously and pleasingly placed, how attractive they are!

There is great satisfaction in a well kept hedge, giving a trim but attractive boundary to the lawn or the garden, or screening unattractive objects beyond; and again, the homelike and softened effect of a vineclad house, how much we admire it!

In Canada the use of ornamental trees and shrubs is not at all general, although the abuse of them has been very great. In the country where the opportunities for beautifying the home grounds are abundant, very little is done, and the farmers' homes, in the great majority of cases, are most unattractive places indeed. Our cities, towns and villages are, in many cases, little better, except in limited areas, the unattractive dwelling houses being unrelieved by shade trees on the streets, or by ornamental trees and shrubs on the private grounds. All the native trees and shrubs have, in many places, disappeared, the natural beauty has gone, and instead there are houses with hard and ugly outlines.

In 1908, the Ottawa Horticultural Society offered to supply ornamental shrubs and vines free to residents on some of the most unattractive streets in Ottawa, and to plant them as well. Circulars to this effect were sent to every resident, but the movement was not popular, the people did not wish the planting done, the main reason given being that if their places were made more attractive the assessment would be raised, and if the assessment were raised the rent would be raised. Whether their fears were well grounded or not we do not know. The shrubs and vines were planted, but planted about public buildings in Ottawa, not private residences. There are some well planted private places in Ottawa, but not nearly as many as there might be.

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*Synopsis of lecture before O.F.N. Club, January 25, 1916.

In 1909, a by-law was prepared by the Ottawa Horticultural Society and submitted to the City Hall, by which tree planting and tree mutilation were to be regulated through a Tree Inspector, under the City Engineer. The planting of certain kinds of trees was to be prohibited, the distance apart of the trees was to be limited, and there were many other good features of the proposed by-law. It was, however, not passed.

When will there be greater uniformity in the planting of shade trees on the streets of Ottawa? At present anyone plants what he pleases, and there may be a hundred kinds of trees on one street for all that is done to prevent it. Ottawa has much to learn from some of the prairie towns in this repect. There the city, not the individual, plants the trees, and plants a whole street with one or two kinds, with the result that instead of a hundred species, more or less, of trees of all ages, there is uniformity, with a much more pleasing effect.

As an example, take Clemow Avenue, where the uniformity of the avenue of elms is most pleasing, although later on they will be much too close for best effect, unless thinned. What an improvement this is over the planting on many of the streets of Ottawa!

A Civic Improvement League for Canada was recently organized, and no doubt, some day before long we shall have a branch in Ottawa. It can do good work by getting an improved by-law under which our trees shall be properly planted and cared for. Ottawa, as the capital of the Dominion, should be the most beautiful city in Canada, and some day it may be. Much has been done to make it attractive, but much remains to be done. The fact that it is situated where the climate is rather cold does not prevent the use of many attractive ornamental trees and shrubs, and few cities in America are so fortunate as to have in their vicinity such a collection of trees and shrubs as is to be found at the Experimental Farm, where their merits may be studied before planting is done in the city.

About 3,000 species and varieties of trees and shrubs may be grown at Ottawa.

For street planting, the Sugar Maple, (*Acer saccharum*), and the American Elm (*Ulmus americana*), are two of the best trees. The maple has not the graceful outlines of the elm, but as a shade tree is very desirable. It grows rapidly, does not split or break easily, and the foliage is handsome in summer and very attractive in autumn. It is not, as a rule, much affected by insects or disease.

The American elm is particularly suitable for wide streets and in front of public buildings, and has an advantage over the Sugar Maple in that it can be pruned up quite high, without making the tree less attractive, but rather improving its appearance; whereas in the case of the Sugar Maple it makes the tree much less attractive if it is pruned very high. The elm is, however, more subject to injurious insects than the maple, and the fall web worm often renders the tree very unsightly.

Among the trees which might be used as a street tree more than it is, is the Red Oak (*Quercus rubra*). This is a rapid growing tree, not a slow grower, as many suppose. The glossy foliage is quite attractive in summer, and it takes on very pleasing shades in autumn. The foliage remains on the trees longer than that the Sugar Maple and much longer than that the elm.

Some of the best ornamental trees are among the native evergreens. The White Pine (*Pinus Strobus*),is the most desirable pine for ornamental purposes. It is more graceful than most other pines, and the foliage is a pleasing shade of green. The Yellow or Bull Pine (*Pinus Ponderosa*), of British Columbia, is a very stately species, succeeding well at Ottawa.

Douglas Fir (*Pseudotsuga Douglasii*), the big tree of British Columbia, after twenty-five years' growth at Ottawa, promises to continue to do well, and is a very attractive tree.

Englemann's Spruce (*Picea Englemanni*), a native of the Canadian Rocky Mountains and Selkirk Mountains, is a beautiful tree, and has thriven well at Ottawa. While not as blue in colour as the Blue Spruce (*Picea pungens*), it has softer foliage and is of a different shape. Those who have grown the Blue Spruce longest find that when the tree gets to be twenty-five or thirty, or perhaps more, years of age, the branches die at the bottom, even when the tree itself is in the open. This is due to the fact that the growth is stronger part way up than it is at the base, and the branches at the base eventually die. The Englemann's Spruce, on the other hand, remains broadest at the base.

The White Spruce (*Picea canadensis*), formerly *P. alba*, makes a fine ornamental tree, but, unfortunately, it has, in recent years, been badly affected with the Spruce Gall louse, which disfigures it very much. While young, or up to perhaps thirty years, the Norway Spruce (*Picea excelsa*), is one of the most attractive evergreens, and is a very rapid grower, but it gets ragged looking as it grows older.

THE FIRE AND THE MUSEUM AT OTTAWA.

By HARLAN I. SMITH, Geological Survey, Ottawa.

The Museum of the Geological Survey, Ottawa, is to Canada practically what the National Museum is to the United States and the British Museum to the United Kingdom. This museum has been greatly affected by the fire which, beginning about 9 p.m., February 3, 1916, destroyed the Dominion Parliament building, and caused the loss of several lives. Before 2 a.m., February 4, while the flames were still spreading, a member of the Cabinet was considering the use of the large auditorium in the Victoria Memorial Museum building as possibly a suitable place for the meetings of the House of Commons, and members of the Geological Survey were holding themselves in readiness to clear any of the other space necessary.

The Geological Survey occupied practically all the building except the three and a half floors in the east wing and an office which was used by the National Gallery. Each hall and wing is practically one hundred and twenty feet long by sixty feet wide.

About ten a.m., February 4th, the morning of the fire, the Survey staff was informed of the intended use of the building as a temporary home for the Dominion Parliament. The large auditorium with its gallery, which was only partially furnished and had been but little used for lectures, was immediately released from museum uses, and prepared by the Department of Public Works, so that the House of Commons was enabled to begin its session at 3 p.m, or in less than twenty hours after its deliberations had been disturbed by the fire. The throne used by the Governor-General in the privy council room, which was rescued from the fire, served for the Speaker of the House of Commons. A press gallery was built back of the Speaker.

The west hall was occupied by the tentative exhibit of minerals. This exhibit was packed and removed in six hours, or by 4 p.m., Friday, which was less than twenty hours after the fire began. The costly cases in which these minerals were exhibited had meanwhile been taken apart and placed in storage. Rooms for the members of the Senate were made here.

The west wing, which was being prepared for geological and mineralogical exhibits, was cleared before Monday noon. The Senate met at 8 p.m. on Tuesday in this new chamber, which had been vacated by the museum within seventy-five hours after it became known that the Senate would meet in the museum.

The east hall, with invertebrate palaeontological exhibits, similar in size to the other exhibition halls, contained thousands of small and delicate specimens. These were all carefully wrapped, packed and taken away. Forty hours after the beginning of the fire, all the museum specimens and cases had been moved from this part of the building, which was made into offices for the members of the House of Commons.

Of the east wing, containing tentative vertebrate palaeontological exhibits, three-quarters were cleared, and these exhibits were stored, with those of the other quarters, along the walls of the southern half of the hall. This clearing involved not only the moving of small exhibits in cases, but also of such heavy fragile specimens as the titanotherium and the skulls of dinosaurs and mammoths, yet it was all done within two hours after this notification, that is by noon, or in less than twenty hours from the time that the fire broke out.

The ethnological specimens were taken out of the tower hall, which was then fitted up and used before Friday noon as a newspaper library corresponding to the one where the fire originated.

Before noon, that is within less than two hours after notice, the tentative exhibit of Canadian archaeology, in seventeen cases, covering three-quarters of the west hall, was cleared of specimens and cases, while the tables upon which the cases stood were left for the use of the members of parliament. The specimens were transferred to sixty-eight trays and stored in the archaeological laboratory in the basement. Meanwhile the remaining quarter of the hall had been cleared of a tentative exhibit of entomology in four cases. In this hall a place for the press gallery staff to work, various offices for members of the Senate, and offices for the Hansard staff, which records the deliberations of the House, were made ready before Monday noon.

The exhibits in the permanent anthropological hall were left intact. Besides the exhibits the archaeological specimens in storage under the exhibition cases were also undisturbed. The ethnological exhibits which are of specimens from the Eskimo, the Indians of the north-west coast of America, and the Algonquian and Iroquoian Indians of the eastern woodlands, were undisturbed. The aisles in this hall, however, were used for storing furnishings and specimens from various other departments, and for office space for the ethnologists.

The zoological hall, similar in size to the others, was cleared by Sunday noon. This necessitated the taking apart of splendid large group cases, and the dismantling of groups of seals; mountain goat, mountain sheep, musk oxen, and various other exhibits, and the removal to storage in the aisles of the anthropological hall cases, containing exhibits of mammals, birds and reptiles. The space was divided into offices for the members of the House of Commons.

The offices on the second floor were promptly vacated with the exception of two, that of the curator and mineralogist and that of the vertebrate palaeontologist. The invertebrate palaeontological offices were moved to the third floor. The archaeological office was moved to smaller space in the entomological laboratory on the third floor, all specimens being taken to the laboratory. The known loss to archaeological specimens caused by the move from both office and tentative exhibition is negligible, the damage being less than one dollar. Work on monographs will be hampered for lack of space to spread out the material for study, but every specimen is still available, on permanent exhibition, in storage under the exhibits, or in the laboratory, where aisles allowing for the free passage of trays are maintained, though the storage reaches the ceiling in most of the remaining space. The ethnological office was moved into the south end of the anthropological exhibition hall, and the botanical office was moved into the botanical herbarium on the third floor. The library was not disturbed. The vacated rooms were at once occupied, chiefly by the Cabinet and other members of the House of Commons.

The offices, drafting room, workshops, and storage on the third floor, were mostly retained, but the little lecture hall was released. The lectures in course were postponed indefinitely. The zoological study material and the herbarium were undisturbed. The physical anthropological office was concentrated into about half its former space, and an ethnological storage room was vacated.

In the basement the workshops and laboratories were mostly retained, as were the taxidermist department, the laboratory of vertebrate palaeontology, the photographic department, and half a hall devoted to the workshop of the National Gallery. Some work rooms were vacated, however, and the distribution offices, with their vast store of publications and maps, were moved to another part of the city.

Of about a hundred and forty members of the Survey staff, over seventy moved about a mile to a series of buildings recently taken over by the Government on the north side of Wellington Street, between Bank and Kent streets, while some sixty of those most intimately connected with museum work retained room in the Victoria Memorial Museum building. In this work of moving, militia motor lories were pressed into service, as well as sleighs and other transports, and the office furnishings and working specimens went out at the rate of sixty loads in one day.

His Royal Highness, the Governor-General, inspected the House of Commons and the other parts of the Victoria Memorial Museum building turned over for the use of Parliament, at eleven a.m. on Monday, less than eighty-seven hours after the fire began, or less than seventy-four hours after the museum authorities were notified of need for the space.

The Museum retains intact only one and a quarter of the exhibition halls, namely, the anthropological hall and part of the hall of vertebrate palaeontology.

A sample museum, by means of which to advance museum interests in the Dominion, has been begun in the anthropological hall. The archaeological and ethnological exhibits are are intact, some of the best zoological exhibition cases of birds, reptiles and insects, have been placed in the wider aisles where they may be viewed; while mounted mammals and skeletons of various animals have also been placed in the aisles and on top of the cases.

On the whole, the scientific work of the museum may go on practically unhampered. The lecture work is being carried on in other auditoriums. The exhibitions eventually may be facilitated by the present apparent set back, as the museum staff is undiscouraged, and the members of parliament, who are now in daily proximity to the exhibits, and constantly meeting museum workers, may become so interested that they will provide future facilities for museum work in the Victoria Memorial Museum building, or in a building even better adapted for museum purposes. Besides this they may carry home to all parts of the Dominion inspiration to establish useful museums and to improve those already in existence.

ENCOURAGE THE BIRDS—WHAT BROCKVILLE IS DOING.

An interesting movement is now under way in Brockville, Ont., for the protection and encouragement of birds. Definite plans, under the co-operation of the various educational institutions, were decided upon at a large meeting held on March 24, 1916, on which occasion Dr. C. Gordon Hewitt, Dominion Entomologist, of Ottawa, gave an illustrated address.

The movement promises much success, and the committee in charge will, it is hoped, reach their goal, namely, the making of Brockville a city of song birds. Every Brockville boy is invited to make a bird box to exhibit at an exhibition of bird houses to be held on April 28 and 29. Special prizes will be awarded for:—

1. The best house from the standpoint of workmanship.
2. The best bird house.
3. The most artistic bird house.
4. The most unique idea in a bird house.
5. The first house to have a bird build in it.
6. The boy taking the best picture of a bird house after it is placed for the season.
7. The best picture of a bird on or near a bird house made this year, both bird and house to appear in the picture.
8. The best picture of a song bird in Brockville.

The committee in charge of the campaign, namely, Mr. W. A. Remmer, Principal of Public Schools; Mr. G. E. Cox, Instructor of Manual Training, and Mr. W. H. Wood, Secretary Community Work, are to be congratulated on the successful commencement of their undertaking. It is hoped that the boys of Brockville will do their part, and thus lead the way for similar campaigns in other cities. The subject of bird encouragement is one which is gradually receiving more attention from the general public. Outside of the economic value of many of our wild birds, their very presence in our cities is pleasing to most of us, and in inviting them to stay with us, the popular form of invitation is the placing of suitable nesting boxes in our trees.

INDEX
TO
THE OTTAWA NATURALIST, VOL. XXIX., 1915-16

PAGE

Acidaspis 136, 137

Actinolite 66

Adiantum pedatum 128

Æshnidæ of Quebec Province 67

"Agelacrinites," revision of the Canadian species 53

Agrionidæ of Quebec Province 66

Agraülos ceticephalus 41

" *saratogensis* 43

Anthropology, Canadian, at the Washington Meetings 158

Ancyropyge 138

Arionellus ceticephalus 43

Asplenium acrostichoides 128

" *angustifolium* 128

" *felix-femina* 128

" *platyneuron* 128

" *ruta-muraria?* 129

" *trichomanes* 128

" *viride* 128

Aspidium bootii 129

" *cristatum* 129

" *felix-mas* 129

" *fragrans* 128

" *goldianum* 129

" *marginale* 129

" *noveboracense* 128

" *spinulosum* 129

" *thelypteris* 128

Baffin Land, minerals from 63

Bathyurus armatus 39

Benthopecten, notes on genus 10

Bequest to O.F.N.C 9

Birds, protection of, around Ottawa 7

Birds of Algonquin Park 145

Bird encouragement at Brockville 168

Bird Notes from Mulverhill, Man 73

Blue bird 73

Botanical Branch, meetings of 19, 29

Botrychium lanceolatum 129

" *obliquum* 129

" *lunaria* 129

" *ramosum* 129

" *simplex* 129

" *ternatum* 129

" *virginianum* 129

Book Notices 77, 116, 160

Branta canadensis 73

Buprestidæ of Ottawa district 129

Burling, L. D., article by 87

PAGE

Canadian Fisheries Museum 99

Case, a cheap, for small museums 33, 44

Ceratocephala 136, 137

Conchological Notes 51

Comptosorus rhizophyllus 128

Cordierite 65

Correspondence 43

Council; O.F.N.C., and Leaders at excursions, 1915-1916 2

Council, Report of, 1914-1915 7

Criddle, Norman, articles by 94, 99

Criddle, Stuart, note by 32

Cryptogramma acrostichoides 128

" *densa* 128

" *stelleri* 128

Cystopteris bulbifera 129

" *fragilis* 129

" *montana* 129

Deer, wounded, mule, note on 32

Dicranurus 138

Dicksonia punctilobula 129

Dragon Flies of Quebec 66

Diopside 65

Eddy, E. D., Report as Secretary, O.F.N.C 12

Entomological Society of Ontario, 52nd annual meeting of 97

Ennomos magnarius 74

Excursions, spring 1915 20

Fernland, gleanings in 105, 125

Field, R. M., article by 37

Fossil collecting 117

Fyles, Rev. T. W., article by 66

Garnet 64

Germain, Bro., article by 129

Glaphurus 138

Goose, Canada 73

Graphite 64

Gum Damar, use of in paleohistology 101

Hagfish, curious egg of 111

Halkett, Andrew, article by 114

Hawk, Swainson's, some habits of, in Manitoba 94

Herriot, W., article by 151

Herring Gull, notes on 89

Henry, J. K., article by 78

Hudson, Geo. H., article by 101

Jay, Canada 73

Kearns, late J. C., bequest to O.F.N.C., by will of 93

PAGE
Kallima paralecta.............. 74
Kindle, E. M., article by....... 117
Larus argentatus............... 89
Libellulidæ of Quebec Province. 67
Lebetodiscus billingsi........... 56
“ *chapmani*......... 58
“ *dicksoni*.......... 54
“ *loriformis*......... 56
“ *inconditus*......... 61
“ *multibrachiatus*.... 60
“ *platys*........... 59
“ *youngi*........... 58
Literature in library, O.F.N.C..68, 79
Macnamara, Chas., article by... 69
Macoun, W. T., article by..... 161
Members of O.F.N.C.......... 3
Mimicry—some of nature's stra-
tegems....................... 74
Minerals from Baffin Land..... 63
Mineral Occurrences, Canadian,
Johnston's list of............ 116
Morris, Frank, articles by..105, 125
Muscums as aids to Forestry... 131
Museum, Victoria Memorial, and
Parliament Building fire..... 164
Norman, E., article by......... 73
Odocoileus hemionus........... 32
Odontopleura...............136, 137
Odontopleuridæ, genera of..... 135
Onoclea sensibilis............... 129
“ *struthiopteris*.......... 129
Ophicalcite..................... 64
Ophioglossum vulgatum......... 129
Ornithological Work in Can-
ada......................14, 21
Osmunda cinnamomea......... 129
“ *claytoniana*........... 129
“ *regalis*.............. 129
Paddle Fish.................. 114
Pellæa atropurpuria........... 128
Perisorus canadensis........... 73
Pelecypod, a new Ordovician,
from Ottawa district........ 85
Phaeotomus pileatus pileatus.... 73
Phegopteris dryopteris......... 128
“ *hexagonoptera*...... 128
“ *polypodioides*...... 128
“ *robertiana*......... 129
Phlogopite.................... 65
Plethopeltis, validity of genus.. 37
Plethopeltis armatus........... 41
“ *saratogensis*....... 41
Prenanthes mainensis.......... 140
“ *racemosa*........... 141
“ *trifoliata*........... 141
PAGE
Ptychoparia (a) saratogensis.... 43
Polypodium vulgare............ 128
Polyodon spathula.............. 114
Polystichum acrostichoides...... 128
“ *lonchitis*.......... 128
Prince, E. E., article by....... 111
Prizes, O.F.N.C., for collections 20
Programme of lectures......... 100
Psithyrus rupestris............ 75
Pteris aquilina................. 128
Quartz, Rose.................. 64
Raymond, P. E., articles by..53, 135
Rose, a hybrid................ 78
Rhytimya glanulosa........... 86
Rosa gymnocarpa x *R. nutkana*.. 78
Saunders, W. E., article by..... 145
Scapolite.................... 138
Scolopendrium vulgare......... 128
Seed maturity of Ontario plants 151
Selenopeltis.................. 138
Serpentine.................... 64
Sheep, evolution of the......... 90
Sialia scialis................. 73
Sirex gigas................... 75
Smith, H. I., articles by........ 33
44, 131, 158, 164
Sphecia apiformis............. 75
Speechly, H. M., note by....... 43
Spinel........................ 65
Taverner, P. A., articles by14, 21, 48
Tillet, B. C., articles by......74, 90
Totanus flavipes............... 73
“ *melanoleucus*.......... 73
Treasurer's Report, 1914-1915.. 13
Trees and Shrubs, use of orna-
mental..................... 161
Victorin, Bro. M., article by.... 140
Walker, T. L., articles by....63, 116
Water, Deposition of Shallow,
in the Cambrian of the Cana-
dian Cordillera.............. 87
Watson, J. F., Report as Treas.,
O.F.N.C.................... 13
Wilds, the Dangers of our...... 69
Wilson, Alice E., article by..... 85
Williams, M. Y., article by..... 89
Woodwardia virginica.......... 128
Woodpecker, Northern Pileated 73
Wooodsia glabella............. 129
“ *hyperborea*............ 129
“ *oregana*.............. 129
“ *ilvensis*............... 129
“ *scopulina*............. 129
Yellow-legs, Greater.......... 73
“ Lesser.......... 73

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THE OTTAWA NATURALIST

VOL. XXX. OTTAWA, APRIL, 1916 No. 1

ANNUAL REPORT OF THE OTTAWA FIELD-NATURALISTS' CLUB, 1915-16.

The Council of the Ottawa Field-Naturalists' Club has the honour to report on the work of the past season—1915-16.

Standing committees, the Editor and Associate Editors of THE OTTAWA NATURALIST, the Librarian, and leaders of the respective branches, were elected at the first meeting of the Council, held on the 1st of April, 1915. Four meetings of the Council were held during the year, and a fifth called for 16th of March, but owing to lack of a quorum no regular business could be transacted.

THE OTTAWA NATURALIST.

Under the continued editorship of Mr. Arthur Gibson, THE OTTAWA NATURALIST, the official organ of the Club, has appeared regularly during the year, volume XXIX having been completed. Among the more important papers published in the volume, several of which are illustrated by plates or text figures, the following may be mentioned:—

Suggestions for Ornithological Work in Canada, by P. A. Taverner.
A Case for Small Museums, by Harlan I. Smith.
On the Validity of the Genus Plethopeltis, by R. M. Field.
Revision of the Canadian Species of Agelacrinites, by Percy E. Raymond.
Minerals from Baffin Land, by T. L. Walker.
Quebec Dragon-flies, by Rev. T. W. Fyles.
The Dangers of our Wilds, by Charles Macnamara.
Mimicry—Some of Nature's Strategems, by B. C. Tillet.
A New Crdovician Pelecypod from the Ottawa District, by Alice E. Wilson.
Shallow Water Deposition in the Cambrian of the Canadian Cordillera, by L. D. Burling.

The Evolution of the Sheep, by B. C. Tillet.

Some Habits of Swainson's Hawk in Manitoba, by Norman Criddle.

The Use of Gum Damar in Paleohistology (with notes on the genus Benthopecten), by G. H. Hudson.

Gleanings in Fernland, by Frank Morris.

The Curious Egg of the Hagfish (Maxine), by E. E. Prince.

Fossil Collecting, by E. M. Kindle.

Buprestidae Known to Occur in the Ottawa District, by Bro. Germain.

The Genera of the Odontopleuridae, by P. E. Raymond.

Prenanthes mainensis: Notes of the Morphology, Taxonomy and Distribution of this Hybrid form, by Bro. M. Victorin.

Birds of Algonquin Park, by W. E. Saunders.

EXCURSIONS.

The following field excursions were arranged last spring by the committee in charge:—

May 8.—Rockcliffe.
" 15.—Iron Mines at Ironside.
" 22.—Britannia.
" 29.—Aylmer.
June 5.—Wright's Grove, Rideau River.

For most of the excursions the weather was favourable, and the attendance fairly good. About seventy were at the Ironside excursion, which afforded an excellent opportunity for a study of the interesting geology of the old iron mines. The Rideau River excursion was attended by about forty. Attention was mostly devoted to botanical specimens. There were no excursions conducted during the autumn.

LECTURES.

The following is the programme of the series of lectures for the winter season, which was carried out with certain changes both as to time and place.

Dec. 7.—Wheat Improvement in Canada, by Dr. C. E. Saunders, Dominion Cerealist.

Jan. 11.—Canadian Folk-tales and Oral Traditions, by Mr. C. M. Barbeau, Division of Anthropology, Geological Survey.

Jan. 25.—The Use of Ornamental Trees and Shrubs, by Mr. W. T. Macoun, Dominion Horticulturist.

Feb. 8.—The Formation of the Great Plains, by Mr. D. B. Dowling, Geological Survey.

Feb. 22.—The Evolution of Army Sanitation, by Dr. R. Lorme Gardner.

Mar. 7.—The Identification and Nesting of Some of our Common Birds, by Mr. W. E. Saunders, of London, Ont.

Through the kindness of R. G. McConnell, Esq., Deputy Minister of Mines, arrangements had been made with the Lecture Committee to hold all the lectures in the auditorium of the Victoria Museum, but owing to the burning of the Parliament Building, which in itself was a Dominion-wide calamity, the auditorium had to be engaged for the House of Commons, and therefore only the first three lectures were held there. Through the kindness of Dr. White, the assembly hall of the Normal School was put at the disposal of the Club for the remainder three lectures, and that of Dr. Gardner was delivered there on the regular date, that by Mr. Saunders on March 13th, and that by Mr. Dowling on the night of the annual meeting. We have to express our hearty appreciation of the kindness of those gentlemen in granting the use of the auditorium and assembly hall, and also of the kindness of Mr. Sykes, Librarian of the Carnegie Library, for the use of a room in which the meetings of Council were held. Our thanks are also due to the city press for free insertion of lectures, excursion notices and reports.

MEMBERSHIP.

During the year 18 new members joined the Club. The present membership now stands at 325.

Mention is feelingly made of the decease of an ardent member of the Club, Mr. J.C. Kearns, and who before his death testified of his interest in it in a bequeathment of the sum of one hundred dollars. In memory of Mr. Kearns the Council agreed not to appropriate this sum for ordinary expenditure, but to invest it, and to devote the interest accruing to prizes to members of the Club for the best collections of natural history objects as may be determined upon.

It remains to be said that leaders of the respective branches have been busily engaged in their several lines of natural history or scientific work.

The Treasurer reports a balance on hand of thirteen dollars and seventy cents ($13.70.)

Respectfully submitted.

ANDREW HALKETT,
Secretary.

TREASURER'S STATEMENT 1915-16

RECEIPTS.

Balance from 1914-15		$ 36.25
Membership Fees:		
Arrears	$ 81.00	
1915-16	186.00	
1916-17	11.00	
		278.00
Advertisements in THE OTTAWA NATURALIST		88.50
Authors' Extras sold		64.40
Provincial Government Grant		200.00
Donation, Paul A. Cobbold, Esq		1.00
Miscellaneous		.90
Copies of OTTAWA NATURALIST sold		12.30
		$681.35

DISBURSEMENTS.

Printing THE OTTAWA NATURALIST, 3 Nos. of Vol. XXVIII. and 9 Nos. of Vol. XXIX	$420.70
Illustrations	19.10
Authors' Extras	87.60
Miscellaneous printing, envelopes, etc	24.69
Postage, THE OTTAWA NATURALIST to members	34.40
Editor	50.00
Lectures expenses	13.00
Postage, bank exchange, etc	18.16
Cr. Balance	13.70
	$681.35

Audited and found correct.

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G. LE LACHEUR,
Treasurer.

THE FORMATION OF THE GREAT PLAINS OF NORTH-WESTERN CANADA.*

D. B. DOWLING.

The plains of Canada form but a portion of the larger plains of the continent, which occupy a large part of the interior and are divided into an eastern and a western portion by a great central valley. The eastern plains which extend to the St. Lawrence lowlands are forested and, therefore, seldom referred to as plains. Westward, the rainfall being lighter, there is a thinning of the forests and there are more open areas. These are generally referred to as the plains. In Canada the open prairie of the plains is being invaded by the forests from the north, so that a division can be made of treeless plains, plains with scattered trees, and forested plains.

The first requisite in a definition for these plains would perhaps be a nearly level surface, supplemented by a soil covering, and a climate admitting of the production of some vegetation, for the absence of moisture soon produces desert conditions. The formation of a level surface, to take a homely example, suggests either *planing* or *plastering*. The planing process of nature is a slow decay of the old surface and its removal by erosion. The surface thus planed is inclined to be rocky, and, as it is losing its rock waste, the soil is to be found sparingly in the hollows or valleys. In plastering, the nature process consists of the spreading out, generally by large bodies of water, of the rock waste poured in by the streams. This produces a more perfectly even surface outline than is ever produced by the planing process, but our surface features are the product of both. If the surface were a part of a perfectly rigid sphere, it would be difficult to explain the presence of large areas containing the rock waste, or of those plains built up by the spreading action of the sea, but as there is a vast amount of evidence showing that the continent has not been stable but sank in certain areas, rose in others, and repeated the sinking and rising several times, we are forced to believe that the crust is flexible, and that its equilibrium is influenced by tangential strains or the shifting of load. To this we owe the submergence of those parts which received a coating of rock waste deposited by the sea. Much of this rock waste underlies the great agricultural areas or plains, so that we may say that the flexibility of the crust made possible the peopling of the earth by providing soil covered areas for the plant growth necessary to support the animal life. The plains of North America bear in their underlying rocks records of long invasions of the sea, and these form a part of the history of a continent which seems to have been a very old feature.

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*Resume of lecture before the O.F.N.C., March 21st, 1916.

Much of its early history is very obscure, but we know that at several periods the ocean encroached and almost submerged the continent. The maximum submergence was probably in Ordovician times, when much of the limestone deposits of the continent were formed. Later the seas seemed to have been shallower, and the rocks formed by the debris entering the sea were of a fragmental character, and became better soil makers. The plains of eastern America owe most of their fertility to the decay of these rocks, but the western plains, now called the Great Plains, received still further treatment beneath a shallow muddy sea which covered the sandstones and limestones of the former plain by a heavy coating of mud now hardened to shale. Then when the sea invasion was about over, the great mud flats supported a very rich vegetation, which is preserved in coal seams. The later additions to the building of the plains consist of coarser material, and indicate a nearer source of supply which means an elevation of the land underlying and adjoining the western edge of the basin. With the draining away of the salt water there was an additional elevation in the land area which amounted to mountain building. This consisted of the formation of folds as a partial relief from the tangential strain, but as the movemen continued, probably too rapidly for the material to follow without fracture, most of the folds became broken.

We thus find as a typical structure in the Rocky Mountains fault blocks piled one against the other in regular succession, repeating the same series of beds many times. In front of the broken area, or to the east of it, folds and breaks of less intensity and lower elevation occur at present, and towards the east the decreasing disturbance in the rocks show very clearly that the strain was from the west. The formation of the Rocky Mountains is about coincident with the elevation of the plains, for in their slow rise the soft rocks forming the covering of the broken folds were washed down and carried across the plains by the streams or spread out in lakes. On the completion of the first period of erosion, after the appearance of the outer mountains, the plains presented probably a rather rough rock-strewn surface on the higher slopes. The removal of much of this debris was made possible only by a further elevation, and with a steepening of the slope eastward the second scoring began. This was continued until from the surface hundreds of feet were removed. The cycle of denudation was not completed, as is shown by fragments of the first surface which still remain.

The coming of the ice sheet of the glacial period is thought to have altered the general topography but little, with the exception perhaps of a smoothing of the uneven surface or a filling up of sharply cut valleys. The period during which the ice was wasting or melting is marked by many drainage channels that are now abandoned. The occupation by the glacier of the valleys of the principal streams which have a northeastward trend, caused no doubt a damming up of the water which, together with that from the melting ice, overflowed along the ice front and sought channels that were almost at right angles to the original channel. Many of these are still used as part of the present river courses, but in the southern portion of the Canadian plains there are many of these glacially-induced channels that are now abandoned, and have apparently no other reason for their existence. The Saskatchewan drainage was diverted to the Missouri for a short period while its former valley through the Coteau was blocked by ice. The diversion filled lakes Chaplin and Johnston and proceeded south, scouring out the valley now occupied by Lake of the Rivers, Willowbunch and Big Muddy lakes. A little later the outlet was shifted to east of the Coteau, and the Regina plain was a lake basin drained by the Souris river probably to the Red River valley. This lake was lowered by the retreat of the ice to a position farther north, and a new channel was again adopted. This was deeply cut by the flowing stream, and is now used by the Qu'Appelle and Assiniboine rivers, which have but a small flow at present.

The melting of the ice in the lowlands of the Red River valley created a lake along its front that was not as readily drained as was the case in the retreat of the ice cap across the prairies. In the Red River valley there seemed no outlet, and the basin filled until it spilled over its lowest point, far south in Minnesota at Lake Traverse. The removal or melting of a vast mass of ice in the north seems to have resulted in a slight elevation of the crust that had been depressed by the weight of the ice. This recovery, which means an actual tipping of the lake basin, lowered the lake by spilling its water to the south, and as the lake at its several stages formed beaches, the levels of these give us the amount of tilt that occurred between their dates of formation. This outlet was abandoned when the lake secured a lower northern outlet. The greatest depth of water over the site of the city of Winnipeg was about 560 feet.

The benefit of this old lake to the agricultural value of the Red River valley can hardly be measured. Over the surface of the boulder clay, which covered the limestone outcrops, the waters of the lake spread a thick coating of the finely-ground shale that was excavated in the digging of the several large valleys that cut through the plateau to the west. This deposit, in lessening amount and thickness, is found over the lake basin area north of the Red River valley, and underlies the plains around Dauphin, Swan and Red Deer lakes.

On account of the soft nature of the rocks the stream valleys are deeply incised, which adds to the difficulty of using this passing water on the upland where it is often needed, since the rainfall is barely sufficient during some seasons to make up for the evaporation. Were these rivers nearer the surface the question of diversion would be simple, but long and expensive canals are required. The surface is generally treeless owing to the light rainfall. Tree planting is proceeding rapidly and is quite noticeable in Manitoba, where the bare prairie is rapidly disappearing. This, if it does not induce a much greater rainfall, retards the evaporation of the ground moisture.

As a short summary, we may repeat that the basin which received the muddy deposits of Cretaceous time has had a varied history. The rocks of the western margin were elevated and broken into long narrow blocks, which are piled up in succession to form the Rocky Mountains. A second strip was strongly folded but not elevated as high as the mountains and constitutes the foothills. A third strip formed a ridge in advance of the folded foothills and now shows a simple synclinal structure, while the remainder, less disturbed but slooping generally to the east, forms the Great Plains of the northwest provinces.

SPRING EXCURSIONS, 1916.

May 6—Rockcliffe to McKay's Lake and vicinity—Geological excursion.

May 13—Cache Bay, west of Hull—General Zoological excursion.

May 27—Ferry Lake and vicinity—The study of Botany to be given special attention.

June 10—Aylmer Park and vicinity—General Zoological excursion.

June 17—Experimental Farm—Attention to be given chiefly to practical Botany and Horticulture.

THE MAGPIE IN WESTERN ONTARIO.

The magpie has long been recognized as an erratic straggler, but it has not happened to strike the eye of any observer in the Western Peninsula of Ontario of late years; but on March 31st, at 3.30 p.m., one flew over the farm of Mr. J. T. Miner, at Kingsville. He and his son were out, probably looking at the geese, of which there were at that time between five hundred and one thousand visiting him, and they noticed a bird crossing the farm to the north of them, and took it for a blue jay, but the tail was so long that they examined it with a field glass and found that the wings had white patches on them, and "the tail was as long as the body and dark." The flight was much like that of a blue jay.

Such a definite description from two good observers like Mr. Miner and his son should make a valid record of the occurrence of this species.—W. E. SAUNDERS.

CORRESPONDENCE.

THE EDITOR, OTTAWA NATURALIST:—

I should like to know, through the OTTAWA NATURALIST, the largest beaver ever caught, and the largest specimen in any museum. I am at present having one mounted which weighed 70 pounds. This was captured by Mr. Dan Patton, Midnapore, Alta. Mr. Thompson-Seton mentions one of 68 pounds in his "Northern Animals."

N. B. SANSON,
Curator, Govt. Museum, Banff, Alta.

UNUSUAL BIRD RECORDS AT MONTREAL DURING THE FALL AND WINTER OF 1915-1916.

Larus marinus, Black-backed Gull.—Nov. 3, I saw a female in the possession of Mr. Dumouchel, taxidermist. He informed me that this was shot at Cedars Rapids (near Montreal) on Oct. 31.

Larus philadelphia, Bonapartes Gull.—Nov. 1, I saw one at Dumouchel's shop, shot near Montreal on Oct. 28.

Branta canadensis canadensis, Canada Goose.—On the night of Jan. 21, a flock flew over St. Lambert (opposite Montreal) in a south-westerly direction, and were heard honking for several minutes. Geese were again heard a few nights later, although no record of the exact date was kept.

Buteo borealis borealis, Red-tailed Hawk.—On Oct. 28 I saw an adult male at Dumouchel's, shot near Montreal on Oct. 24.

Astur atricapillus atricapillus, Goshawk.—On Oct. 31 I saw one in flight; also on Nov. 3, I examined an adult male, shot on the Island on Nov. 1, in the act of devouring a domestic fowl.

Cryptoglaux funerea richardsoni, Richardson's Owl.—Nov. 21, I secured an adult male.

Hesperiphona vespertina vespertina, Evening Grosbeak.—Feb. 1, I saw two adult males, shot on the Island at Pointe aux Trembles on Jan. 30. On Feb. 18, I saw one adult male and three females or immature birds feeding on seeds of shade ash trees at St. Lambert. Again, on Feb. 24 two flocks, consisting of twenty-four birds, were feeding on ash seeds in the same locality. Of these, five were bright-coloured males. This species is still with us in considerable numbers at the present date (Feb. 28). The seeds of several Mountain Ash trees in the vicinity have been quite ignored.

Junco hyemalis hyemalis, Slate-coloured Junco.—On Jan. 23, I saw one with a flock of Chickadees.

Bombycilla garrula, Bohemian Waxwing.—Jan. 21, I saw three freshly-mounted birds at Dumouchel's. These were secured near Montreal on Jan 13. On Feb. 9 I heard the burr-like song of this species at St. Lambert, but failed to see the singer. Feb. 14, while passing the same place, I again heard the notes, and discovered an individual of this species in a maple tree, and had a fine view of the rufous under-tail coverts.

Of the above-mentioned species the Red-tailed and Goshawk are perhaps not rare here, but my records are so few that I always consider them worthy of note. I have never before observed either the Canada Goose or the Slate-coloured Junco during the months of January or February, and their occurrence was probably due to exceptional mild weather, with a steady south wind preceding their arrival.

There has been a remarkable absence of several of our most common winter visitors, notably Pine Grosbeak and Redpoll, due possibly to the open weather. On the other hand, Chickadees and Red-breasted Nuthatches have been more common than usual. Snow-birds are scarce, and only seen in small companies. During the fall and early winter I was struck by the unusual abundance of Hawk Owls to be seen in taxidermist shops. These were mainly shot by hunters in the Laurentian district.

L. McI. TERRILL, St. Lambert, Que.

THE OTTAWA NATURALIST

VOL. XXX. OTTAWA, MAY, 1916 No. 2

THE USE OF WILD PLANTS AS FOOD BY INDIANS.

By Tom Wilson, Vancouver, B.C.

Previous to the advent of the Christian Missionaries, the Indians of British Columbia did no cultivation, as such. They depended for their vegetable food on certain kinds of roots, shoots, leaves and berries which grew in their immediate neighbourhood, or which they might come across in their wanderings.

The coast Indians were fishermen and lived mostly in villages, but were partly nomadic as the seasons changed. The interior Indians were wholly so, and lived by hunting and trapping. Their methods of preparing vegetable stores varied with the locality and its climate. Fruits, such as saskatoon, salmon berry, etc., among the coast Indians were beaten to a pulp, partially fermented, then mixed with fish or bear's grease, and so kept, while in the dry or arid part of the country sun drying or evaporation was the method. This was prevalent among the Indians of the Lillooet, Shuswap, Okanagan and Similkameen countries, and to a limited extent among the Kootenays.

Commencing with the Service Berry, *Amelanchier florida* Lindl. and *A. Cusickii* Fern, Saskatoon, Stcokim, Sheea, or whatever happens to be the local tribe name, it is certainly the most important berry in their estimation. It grows plentifully in different parts of the province, extending up the coast as far as Alaska, and even into the interior and away beyond the confines of British Columbia. On the coast, the berry was pulped and mixed with oolachan grease, then pounded and moulded into cakes. This practice was carried on by the Tsimtsians, Tclinkets and other coast tribes. In the dry belt the berries were simply sundried.

The Soap-oolalie, *Shepherdia canadensis* L., was partially cooked by spreading on layers of damp grass after pulping and allowing it to steam over hot stones. The fruit was bitter, though not unpleasantly so. It was highly prized among the Indians, and an extensive trade existed between the people of the Thompson River and those of the coast, where it grows very sparingly. It evaporates easily, and when for any reason the people were rushed, the berries were sundried, and in this condition they kept very well. When wanted for use a quantity was put in a vessel and covered with warm water for some time; after softening it was beaten with an instrument like an egg beater, when it foamed up like soap suds (hence the name), or like pink ice cream. This would be flavoured with some fruit juice and eaten with a spoon. In other cases the berries were allowed to ferment, and a highly intoxicating liquor was the result, but the effect was not nearly so lasting or so injurious as bad whiskey.

The fruit of the choke cherry, *Prunus demissa* (Nutt.), Dietr., Zotku, according to the Thompson Indians, was gathered by the interior Indians, but this fruit is not known by the coast Indians, as the tree is not found within 80 or 90 miles of the coast. The berries were usually dried for winter use.

The Black Cap, *Rubus leucodermis* Dougl., grows luxuriantly and bears a heavy crop, which is easily picked. This fruit lends itself well to evaporation.

The Salmon Berry, *Rubus spectabilis* Pursh., is by far the most handsome of this genus. It grows luxuriantly all along the coast, and to a distance inland of about 80 miles. The fruit is large, sometimes of a deep crimson colour when ripe, at other times of an amber colour. As it is largely composed of water it will not dry up and is apt to rot. The Indians were in the habit of mixing the berries with bear's grease and boiling them, and so making a kind of jam.

The "Salal," *Gaultheria shallon* Pursh., which grows abundantly on Vancouver Island, and also on the coast of the mainland, some places forming an impenetrable jungle, bears heavy crops of a very wholesome berry, which was picked in large quantities by some tribes. With other tribes the berry was not a favorite. If the weather was favourable attempts were made to evaporate the fruit, otherwise the berries were cooked with grease.

The common wild crab apple was gathered to a limited extent by some of our Indians.

In the foregoing remarks mention has only been made of some of the fruits gathered and eaten by our Indians. In addition there is a long list of roots which were gathered and stored for food.

On the south-east end of Vancouver the favourite bulb, "La camas," *Camassia esculenta* Lindl., as well as several of the wild onions, are still largely gathered, and form an important item of vegetable diet. In Lillooet, also, the wild onion is gathered; in fact, the name Lillooet means "wild onion."

Among other bulbs and roots I may mention: *Lilium parviflorum* (Hook.) Holz, "Makaoeza," in the Thompson language, and "Skamiz," *Erythronium grandiflorum* Pursh.; "Spitlum," *Lewisia rediviva* Pursh., or Bitter Root; all were eagerly sought for. The latter, which is extremely nourishing, was eaten either fresh as it was dug, or threaded on a piece of string and dried, very much as apples were in Canada in olden times.

One root known by the name of "potato" was frequently collected. This was the corm or root-stock of *Claytonia lanceolata* Pursh. These roots vary in size from that of an ordinary marble to that of an egg. They are very rich in starch, and contain a good deal of nourishment. This plant furnished the principal root crop. Certain families looked on certain pieces of ground as their own potatoeilihie (potato ground), and I know an Indian to-day whose sole title to his land is owing to the fact that his mother, grandmother and other generations had been in the habit of digging "potatoes" on that patch. The "potatoes" are all gone now, but some of the land is growing wheat, and part is in orchard.

Bracken roots were occasionally boiled and eaten, but only in extreme cases, though a fairly nutritive food could be made even out of that unpromising article. Fungi of different kinds were also eaten, sometimes raw; very often they were sundried for winter use.

I come now to one of the strangest-looking materials for food purposes, namely, the lichens of the dry belt, which hang like old men's beards from all the coniferous trees, *Alectoria jubata* L. The process of preparation was something like this: A large pit was dug in the ground and the inside made as smooth as possible. A fire was then built inside, and the pit thoroughly heated. The ashes were then thrown out and the pit received a lining of damp grass, on which was laid a layer of "moss," (lichen). Another layer of damp grass, then more lichen, and so on till the pit was full. It was then topped off by more grass, and hot stones were laid around and over the whole mass, and it was kept as hot as possible for a day or more, when it was then supposed to be cooked. If not well prepared it was apt to mildew, but I have eaten it a month after cooking and it was quite good.

Among the Indians of the interior the most important, I may say the only plant used for cordage purposes, was Spatsum, *Apocynum cannabinum* L. The fibre was treated very much the same as hemp, and from it was made fairly thick rope and the finest thread. This was usully spun by the women, between the palm of the hand and the naked thigh.

What would the coast Indian be without the Cedar? Literally lost. Out of the mighty logs he chipped, hewed and burnt his great war canoe, often sixty feet long, and in which he did not hesitate to brave the wild waters of the Pacific, when he went off on a foray on some of the other weaker or less prepared tribes, after which he brought back the spoil, and sometimes captives, to the great potlatch house, sometimes one hundred and fifty feet long by fifty feet wide, all built of cedar—even the great totem pole that stood in front, telling maybe of the owner's pedigree, or perhaps the story of some adventure that he had had. And then the dance, which would be sure to succeed the successful foray. Why, the dancers themselves were ornamented with ceremonial masks of grotesque-looking animals, and these again had been cut out of cedar wood, while the clothes they wore were for the most part made from the inner bark of the tree. And while the dance was going on an old crone might be seen spinning a fishing line from the same material. A great tree the cedar, *Thuja plicata*, Donn.

Three different plants were smoked before the Indians had access to T. & B. or Old Chum. Among the Kootenays the inner bark of the Red Willow, *Cornus stolonifera* Michx., was used sparingly, and very probably the custom was borrowed from the Indians of the plains when they went through the passes to hunt the buffalo.

The leaves of the *Arctostaphylos uva ursi* (L.) Sprengel, were smoked under the name kinnikinnick; the name certainly was borrowed from the east.

The third plant was a veritable tobacco—albeit of poor quality, *Nicotiana attenuata* Torr. This was gathered in bundles and dried, and so smoked; it must have been very hot smoking.

Of the medicinal plants I shall only mention one, and not attempt to write the name that the Squamish Indians call it. It is difficult enough to pronounce. The plant I refer to is "Cascara," *Rhamnus Purshiana* DC The bark of this tree has been known to the Indians for ages as a medicine, and from the Indians it was adopted by the old miners and prospectors. No "old man of the mountains" would think of being without a bottle of the decoction made from barberry bark and Oregon grape when far from a drug store. It is less than thirty years since Cascara became such a popular medicine among the whites. Usually a clump of *Rhamnus* may be noticed near an Indian village. It will be seen that though strips of bark have been removed that they have been taken vertically, and the tree is never entirely girdled, but is treated, in a crude way, very much the same as the Cinchona is treated in Ceylon and Java. And yet the trees grow vigorously.

There is an old saying that "he who takes what is to hand will never want." This was true of the Indians before the white man came among them. They always had enough to eat, such as it was. Now they sometimes suffer from hunger. Once they had the whole country to roam over, to hunt, fish, pick berries and gather roots. Now the area is circumscribed, and the habits of a people cannot be changed in one or two generations. An Indian friend of mine made this remark: "I'm afraid we are trying to be white men too rapidly."

The list of plants given above is not by any means complete, but enough has been given to show that the "poor Siwash" took what was at hand.

SOME NOTES ON FOSSIL COLLECTING, AND ON THE EDRIOSATEROIDEA.

By GEORGE H. HUDSON.

The timely and valuable paper by Dr. E. M. Kindle on "Fossil Collecting," which appeared in THE OTTAWA NATURALIST for January, 1916, has led me to present certain notes and problems belonging to the same subject.

We may group the history of fossil collecting into three overlapping periods or stages. At first specimens were saved out of simple curiosity, and in the "cabinet" they found themselves associated with minerals, archæological specimens and objects of recent historic interest. In this stage only the more showy or curious forms were preserved, and a trilobite might find a setting within the coil of a hangman's rope.

In the second stage the principle focus of interest was also the "cabinet," but this reflected more of the developing individuality or intellectual advancement of the collector, in that it showed a more restricted field and a devotion to its amplification. Certain persons limited themselves to fossils only, and came to value their collection by the number of markedly distinct species presented, and by the perfection of the specimens. Duplicates were saved principally for purposes of exchange, and closely allied species or varieties were rejected as not being *typical*. The idea of the fixity of species was responsible for this attitude. This stage was of the same type as that displayed in coin or postage-stamp collecting, save that it was less discriminating; for in the latter groups an exceedingly slight change in die or plate often enhanced the value of the specimen. As the principle interest shown by second-stage fossil collectors was a "stock-taking" of ancient life, we might call this the inventory stage. This "inventory," however, necessitated the giving of names, the description of types, and the classification of the whole—it was in consequence a "systematic" stage.

The third stage we may call the problem stage, and here, for the first time, we meet with collectors whose purpose is the development and illustration of biologic laws and the modern concept of organic evolution. The material collected must throw light on derivation; on distribution in space and time; on the effect of comparatively fixed or changing environments; and on the advancement or ultimate failure of the groups under investigation. To solve these and other biologic problems, the student must acquire a more thorough knowledge of ancient structure and function, and this can only be acquired through material capable of illustrating minute anatomical detail—both external and internal. Specimens are now saved, not so much for their individual completeness, as for their evidence concerning details of structure. A display series representing this stage is rarely to be seen outside of our larger museums.

The first stage is frequently represented to-day by the contents of a boy's pocket; the second stage by the amateur collection of fossils; and the third stage by the mass of fragments and sections found in the paleobiologist's work-shop. The first stage is of little educational value to the average adult. The second stage, however, is of great value to the general public (where it has access to such collections); to the student of geology, for by its means he comes to recognize forms that enable him to identify strata of the earth's crust; and to the student who desires to enter the field of paleontology, or to become acquainted in a general way with the past evolution of life. The third stage is of vital importance to the world's progress in more ways than we have room to enumerate, and in ways yet unknown to the searchers themselves.

We should recognize the fact that collectors in their individual development usually recapitulate these historic stages, and that a collector may become arrested in his development during the first or second stages. He may branch out at one of these levels and become a "new species," but as his work is usually typical of a stage, we shall find it convenient to speak of him as a collector of the first, second or third *types*.

The work of collectors of the first and second types is, in needless ways, antagonistic to the work of those of the third type. For instance, the inexperienced collector makes a surface find, and with chisel and hammer proceeds to secure his specimen. He begins with great care to cut a groove around it to enable him to preserve it on a rectangular block, which will display well in his cabinet. Before he has completed his work a fissure develops which cuts across the specimen and removes perhaps a third of it. To his mind this specimen is spoiled. He throws away the separated fragment, and disappointedly leaves his find in order to search for another. I cannot but contrast this procedure with that of a collector I well remember. In breaking off a part of a ledge some portions of a rare trilobite were discovered. Before attempting to remove the rest of the specimen this collector first secured all fallen fragments which preserved any portion of it, and fastened them to the removed piece with a little glue. The portion still remaining in the cliff edge was next secured and the whole carefully wrapped in paper and tied together. I recall an instance in which a specimen, after being freed from its matrix in the workshop, showed the loss of a portion of a remarkably long caudal spine. In the following year the original collector made a long journey back to the quarry, found the place from which the specimen was taken, and secured the rest of the imbedded spine.

Attention is called to the destructive work of the amateur, because he outnumbers the experienced collector ten to one, and not only destroys much valuable matter in the field, but oftimes loses his interest in his own collection, and allows it finally to go the way of all waste. Particularly is this true in the neighbourhood of certain boys' summer camps, where "nature study" leads them afield with their "councillors," and where indiscriminate collecting is encouraged. The damage inflicted by the amateur is wholly unintentional, and the more experienced worker has but to take an interest in the younger collectors to make them very helpful allies.

The amateur is not the only person who injures the field in which he operates. Many experienced collectors of the "second type" still have the dominant idea that well-nigh perfect specimens are alone worth saving. This, to my knowledge, has led some of them to crush with the hammer certain finds that they had stopped to examine and found defective. This impulse to destroy in the field may arise from disappointment, or from the desire to avoid being misled at a subsequent visit.

To the above loss we must add that which often occurs when the "cabinet" is re-arranged and many specimens thrown away. Because of the great difference in point of view between collectors of the second and third types, this loss may be a serious one.

Some will doubtless think the picture overdrawn. To their minds the supply of fossil forms is practically inexhaustable.

We may grant this so far as very common species are concerned, and for most specimens taken from below the present rock surface. There are two fields, however, in which the loss is not only real but at the same time serious. I refer here to weathered surface material and to rarer species whose structure is not fully known.

Well weathered material may in a single specimen reveal many minute details, both of outer surface and interior. If the nearly complete form is preserved, such a specimen may be saved, and finally yield new truths to some paleobiologist. On the other hand any great loss of surface or of other portions of the whole may make the specimen one of little or no value to a collector of the second type, yet the fragment might show details of inestimable value to the collector of the third type. We must elaborate these statements somewhat in order to get a clearer idea of their import.

A complete specimen may do no more than add a new species to our ever growing lists, while a well weathered fragment may add largely to our knowledge of the structure and function of a whole order. For example, the type of *Blastoidocrinus carcharidens* Billings, shows less than half of a complete specimen, but it reveals the character of its food-grooves; cover-plates; floor-plates; the drainage tubes situated between the outer ends of the latter and leading into the hydrospires; the outer surfaces of the hydrospire folds; the exceeding thinness of the latter, fitting the organ to perform the function of respiration; the fine corrugations on their inner surfaces, giving strength with extreme lightness; the external openings or discharge pores, showing the direction of flow to be downward (cataspires), and not upward (anaspires) as in the blastoidea; and the true basals. (See N. Y. State Museum Bulletin 149, plates I-IV.) Not one of these things was to be seen in the well-nigh perfect specimen collected by E. M. Hudson on Valcour Island, until it was sectioned, and even then the details shown were neither so numerous nor so complete as in the holotype, and in other still smaller fragments. (N.Y. State Museum Bulletin 107, plates 1-4). The holotype also demonstrates the absence of a lancet plate, and is itself clearly an example of a new order of Echinoderms, the *Parablastoidea* (last reference, page 119).

Let me refer to another specimen less than "half there." This is the type of *Protopalaeaster narrawayi*, papers on which appeared in THE OTTAWA NATURALIST in May, June, July and December, 1912, and October, 1913. In addition to these papers the species was figured in N.Y. State Museum Bulletin 164; by W. K. Spencer, in part I of his "Monograph of the Paleozoic Asteroidea," 1914; and further shown by a fine plate in Schuchert's "Revision of Paleozoic Stelleroidea," U. S. National Museum, 1915. Schuchert's additional material indicates that the type specimen had lost practically its entire apical skeleton. It, however, reveals structures not yet seen in any fossil sea-star ever collected before. This rare find of Mr. J. E. Narraway at City View should prove of interest to the readers of this magazine, and it is to be hoped that other fragments of this species will be found, as there are many points in its structure not yet satisfactorily explained.

A study of the specimen figured by Raymond, in OTTAWA NATURALIST, December, 1912, is also one of those marvellous dissections and preparations by nature which has so much to say concerning the minute anatomy or histology of an extinct subclass of Asterozoa. This specimen I have treated in an article which will appear in the Director's report of the N. Y. State Museum for 1915.

Now, we must bear in mind that Mother Nature has worked for hundreds of years on some of her surface material to prepare it in a manner that man cannot yet imitate. We might say that as a carefully dissected and preserved frog, so prepared as to display its internal organs, would have a greater money value than an ordinary dead frog, so would a dissection and preparation at nature's hands of one of her buried forms enhance its value. At the same time, however, we should bear in mind that the dissection of the frog is a much easier matter than the dissection of any fossil. The field of weathered surface is certainly limited, and collectors in any region that has been frequently visited will tell one that good finds are not so abundant as they used to be. When surface material has so much to tell, it is certainly a matter of regret to have a large percentage of it destroyed through ignorance and carelessness. It becomes a duty then to conserve this material, and to make it widely known that well weathered specimens of all uncommon species, even though very fragmentary (such as the separate ossicles of Blastoidocrinus, figured in N. Y. State Museum Bulletin 107, plates 4-7) is desired for study of external ornament, form of ossicles, or other elements of structure, manner of articulation, growth stages, etc.

Buried material is, of course, limitless so far as common species are concerned, but for all rare forms such material is desired for study through development and sectioning. In many cases fragments might be of inestimable value.

(To be continued.)

BIRD NOTES.

An influx of Evening Grosbeaks occurred during the month of March, large flocks appearing within the city limits and in less settled districts nearby. The birds were so conspicuous and popular that many interesting items appeared in the daily press. A number of ignorant people either trapped or shot these birds, but the timely intervention of the proper authorities prevented what might have been a wholesale slaughter of hundreds of this beautiful species. The Grosbeaks were subsisting on a diet of mountain-ash berries. Several trees, under personal observation, were stripped bare of berries in two days. The birds have apparently gone northward again, as none have been seen since March 26th. On March 28th, on the mountain side, I noticed a dead male, which was in perfect condition and had not been shot. Perhaps this bird died of starvation, as others have been lately picked up and their crops have been empty.

The Pine Grosbeaks have been conspicuous by their absence, only one male and two females being seen during the entire winter. These were also feeding on mountain-ash berries, and would occasionally drop into a pool of water to take a bath. The birds were quite tame, allowing anybody to approach within a few feet of them.

The spring migration has set in in earnest and quite suddenly. A week ago hard winter conditions were prevailing, but now the weather is warm and summerlike. The Prairie Horned Larks were observed on March 5th. Although crows have been reported from certain farming districts a few miles outside of Montreal during the winter, the first spring arrivals in this locality appeared on March 12th, becoming more abundant each day. On March 26th a flock of Red-winged Blackbirds was noted, and one Bluebird put in an appearance. On March 28th a Song Sparrow was heard, and the day following the birds were common, about fifteen being heard singing in an orchard where there was plenty of brush and cover.

March 30th was a fine, warm spring day. At 4 p.m. I visited an area of low ground some 400 yards square, and flanked on one side by a small stream and a thin growth of alder and willow bushes. This locality was covered by snow and water, and I was immediately attracted by a flock of about 50 Robins, which were probably going further north, and six Bluebirds running over its surface. The Bluebirds would fly into the bushes and quietly drop to the snow again, with an occasional soft call note. The birds were evidently feeding on spiders or insects, but after floundering through slush and water over boot tops, the food question still remained a mystery. At 5.30 p.m. three Robins perched in trees and started warbling, and continued so for ten minutes. The movement of the Robins and Bluebirds over the surface of the snow was an interesting sight. In the hardwoods adjoining, two Yellow-bellied Sapsuckers, one White-breasted Nuthatch, one Downy and one Hairy Woodpecker were seen. As I lingered about a Slate-coloured Junco joined the group on the ground.

Westmount, Que. W. J. BROWN.

ABERRATION IN *HEPATICA ACUTILOBA*.

By Bro. M. Victorin, of the Christian Schools, Longueuil College, Que.

The common Liverleaf of our western Quebec woods, *Hepatica acutiloba* DC., is not only a very handsome plant, but also the subject matter of more than one interesting morphological problem. It can be, for instance, asserted that nearly every beginner in botany has been misled by the three-bracted involucre subtending the flower, thus encountering much trouble in using the keys of the manuals.

That this pseudo-calyx is striclty an involucre is evidenced by the fact that the parts of it show, in certain teratological specimens, a tendency to cleave after the manner of a well-known group of Anemones, of which *Anemone canadensis* L., is a good example. Holsted (1) hints at the fact, and Goffart (2) after a careful study of the leaf anatomy, holds that *Hepatica* cannot be separated from *Anemone*.

We wish to record here some particular instances of abnormality in *Hepatica*. Figure 1 illustrates a specimen collected in Lougueuil, Que., during the month of May, 1914, in which the bracts make a partial return to the leaf form. One of them is nearly perfect in outline, though of small size; the other two are merely enlarged, retaining their original form. The flower itself, markedly depauperate, is dioecious.

In April, 1916, we observed on the St. Bruno Mountain, among a luxuriant growth of *Hepatica*, specimens departing from the type in the following particulars: flowers of an infrequent rose colour, depauperate, dioecious; involucre composed of 4-5 bracts, one of them sometimes bifid.

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(1) Holsted, *Bull. Torr.Bot.Club*, 14: 121.

(2) Goffart Jules. *Recherches sur l'anatomie des feuilles dans les Renonculacées*. Arch. Inst. Bot. Univ. Liège, III, 1901.

The abortion of the stamens and the reduction of the petaloid sepals seem to account well for the increased luxuriance of the vegetative organs. Indeed, a mass of observations point to the fact that, in the metabolism of plants, vegetative and reproductive activity behave in inverse ratio.

The affinity of the genus *Hepatica* with *Anemone* is an interesting problem, and observers should be on the lookout for deviations that may open lines of research.

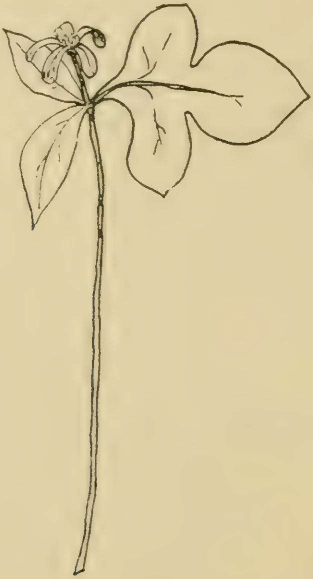

Fig. 1.
Abnormal involucre of *Hepatica acutiloba* DC.

A PRELIMINARY PAPER ON THE ORIGIN AND CLASSIFICATION OF INTRAFORMATIONAL CONGLOMERATES AND BRECCIAS.

BY RICHARD M. FIELD, AGASSIZ MUSEUM, CAMBRIDGE, MASS.

INTRODUCTION.

The term intraformational in contradistinction to interformational was first proposed by Walcott (1) in 1894. He writes: "An intraformational conglomerate is one formed within a geologic formation of material derived from and deposited within that formation." In the same paper he remarks upon the importance of determining the time element or sequence of events in the formation of a sedimentary or clastic rock, by a study of the shapes and textures of its constituents. Thus, in his introduction he writes (p. 91): "Usually the presence of a conglomerate in a stratigraphic series of rocks is a matter of considerable importance to the geologist. He naturally infers the presence of a break in the continuity of sedimentation; an orographic movement of greater of less extent; erosion of preexisting formation." In other words the term conglomerate by its definition conveys to the mind of the stratigrapher a great difference between the ages of the pebbles and the cement. It is proposed to show in this paper that there is often a nice distinction between the ages of the constituents in most conglomerates and in intraformational conglomerates in particular. It is true that we arrive at a knowledge of the sequence of the events which have taken place in the formation of any given clastic by describing the texture and shape of its constituents, but the writer believes that the tendency has been too strong among students of the sedimentary rocks to express their findings in purely textural and structural terms without special thought as to their history and origin. Thus, any rock, be it limestone or otherwise, which is formed of coarse and apparently water-worn materials, is dubbed a conglomerate, and its natural history, even if recognized, is lightly passed over in its classification.

It is not proposed in this paper to attempt a classification of all conglomerates on such a basis as outlined above. A study of certain Paleozoic limestone conglomerates, and especially of certain structural and textural phenomena as exhibited in the limestone formations at Trenton Chasm, Chambersburg, Bellefonte and elsewhere, has led to the belief that a compilation and discussion of the evidence of the so-called intraformational "conglomerates," breccias, or "corrugations," is needed if we are to arrive at exact conclusions regarding certain common phenomena associated with the history of the ancient seas.

Grabau (2) states that intraformational brecciation is "probably in all cases an extreme of subaquatic-gliding-deformation." The writer does not feel that most of the phenomena observed by him in the Appalachians will bear out this statement. The principal example of folding and brecciation cited by Grabau as due to this cause, is the one at Trenton Chasm, New York. Hahn (3) described the folds as due to "subaqueous solifluction." Grabau (sp. cit. p. 785) states that "Deformation through gliding may result in complete brecciation of the deformed layers. The fragments may lie in all positions, as in the ordinary intraformational conglomerates, or they may consist of thin cakes, many of which in the gliding process have assumed a vertical position in the mass. This forms the so-called 'edgewise conglomerate,' common in the Ordovician limestones of the Appalachian region. The characteristics of all these formations seem to point to rather shallow water as the place of deposition of these strata, and the possible periodic exposure and hardening of the surface layers." The writer has been able to prove to his own satisfaction that some of the edgewise conglomerates in the Bellefonte section are certainly not due to subaquatic-gliding-deformation, neither does he believe that any one hypothesis is able to account for the formation of all intraformational conglomerates, whether the orientation of their fragments be "edgewise" or not. He feels convinced that the folds and edgewise conglomerates exposed to view in the gorge at Trenton Falls are, as previously supposed, truly of tectonic origin, and, therefore, not, in the sense of Walcott's definition, "intraformational conglomerates" at all, since they were not "deposited in the formation." A recent study of the Trenton Chasm, in company with Drs. Raymond and Shuler, produced evidence which points conclusively to the tectonic origin of the folds and edgewise conglomerates, as is amply set forth in Miller's (4) recent paper.

It was only a few years ago that ripple-marks and mud-cracks in limestone were considered rare and unusual phenomena. Indeed stratigraphers and paleontologists did not expect to find and did not hunt for such structures in the Paleozoic limestones. To-day the investigators of the Cambrian and the Ordovician calcareous rocks are reporting such data from the

St. Lawrence valley to the Cretaceous boundary of the Paleozoic in Georgia and Alabama. Thus there is gradually being amassed more and more material significant of the diagenesis of the Cambrian and Ordovician rocks, and relating to the history of the seas from and under which they were deposited. It will not do, in this study, to dub all coarse, clastic, intraformational rocks, whose constituents may or may not be rounded, as simple conglomerates all of similar origin. It is believed that a more careful examination of these intraformational structures in the field and laboratory will greatly aid in deciphering the history of the original limestone sediments. Upon the rock-walls of the Bellefonte quarries have been observed many of the structural phenomena which are to be found on shallow water areas, mud-flats and beaches of to-day. Ripple-marks, mud-cracks, edgewise conglomerates and breccias are disclosed in close stratigraphic sequence wherever exposure and subaerial erosion have been able to develop the hidden structures. The conclusion has been reached that nearly all of the intraformational conglomerates and breccias seen at Chambersburg, Bellefonte and Tyrone, Pennsylvania, are of extremely shallow water origin; in fact, their formation postulates an emergence from the sea such as is common under tidal action. That mud-cracked beds and intraformational breccias are in certain cases one and the same thing is, perhaps, the only original contribution to the origin and classification of intraformational structures.

GLOMERATE AND PHENOCLAST.

Before proceeding with the classification of intraformational structures, it seems best to analyze the term conglomerate.* Indeed the study of intraformational "conglomerates" requires a more careful consideration of all conglomerates than has heretofore been deemed necessary. A review of the literature, as well as certain examples studied in the field, has shown that not all intraformational conglomerates are made up of water-worn materials; in fact, certain of them are composed of distinctly brecciated fragments which show no signs of attrition by water transportation, a common characteristic according to most geologists. Walcott (op. cit. p. 192) recognized this difficulty when he wrote: "Care is to be taken that intraformational breccias are not to be confounded with intraformational conglomerates. The former have a wide geographic distribution, and owe their origin to local disturbances within the beds affected, without pre-supposing elevation above sea level and erosion." As will be pointed out later, limestone breccias can be formed under other than truly tectonic conditions. It may seem strange at first to consider a mud-cracked limestone as a brecciated rock, and yet viewed in cross section, or at right angles to the bedding plane, the hand specimen or field section will often show a characteristic brecciated structure. It is, therefore, proposed in the present classification to introduce two new terms, glomerate and phenoclast, in describing all those rocks (glomerate) which are of sedimentary origin, coarse, or psephitic in texture, whether or not their "show" constituents (phenoclasts) give signs of attrition and transportation.

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* Most stratigraphers would certainly agree that true breccias cannot be defined under the general term of *conglomerate*, yet if we refer to the Century Dictionary we discover that although a conglomerate is defined as "a rock made up of the rounded and water-worn debris of previously existing rocks", a breccia is defined as "a conglomerate in which the fragments, instead of being rounded or water-worn, are angular". No less an authority than J. D. Whitney is responsible for these definitions but most geologists would probably refuse to accept them as they stand. Quotation is taken from the Century Dictionary only to show that there is some confusion at least at present in regard to just what *conglomerate* means.

GLOMERATE, according to the Century Dictionary, means "collected into a spherical form or mass." It is an old English word and rarely used. Conglomerate, in its ordinary sense, is also defined as "collected or clustered together," the shape of the materials forming the cluster being undefined; while the geological term "conglomerate" is defined as "a rock made up of the *rounded and water-worn debris* of previously existing rocks, etc.," (the italics are the writer's). It is proposed to use the term *glomerate* in a geological sense to mean any sedimentary or clastic rock made up of roughly graded debris formed within itself or from pre-existing rocks. Such a term would cover breccias, conglomerates and certain other rocks of doubtful origin, and its need will be more obvious further on in this paper. Nauman, in his "Geognosie," proposed the term *Psephite*, but it has never been widely adopted, and probably never will be, although it is a useful and descriptive word in petrology and geology. Nauman defined psephite structure thus: "Die Fragmente, aus welchen die klastischen Gesteine bestehen, sind entweder gross, so dass sie als formliche Gesteinstucke erscheinen, welche theils *eckig* theils *abgerundet* sein koennen. In diesem Falle lasst die structure als psephite-structure bezeichen, weil sich die betreffenden Gestein als Agregate grossere oder kleinen Steinen darstellen" (p. 446. The italics are the writer's.)

PHENOCLAST.—There is as great a need for a term to express the order or size of the constituents in a sedimentary rock as there is for the term *phenocryst*, which designates a large crystal in the ground mass of a crystalline rock. Phenoclast, from *pheno*: show; and *clast*: clastic, broken piece or fragment, is proposed to designate the larger fragments, pebbles or allied forms which are easily distinguished from the ground mass or cementing material. They, the phenoclasts, may be of several orders of size. The term is convenient, as it is not always correct to refer to the major constituents of a conglomerate as pebbles, or even brecciated fragments. For instance, in the edgewise "conglomerates," the "pebbles" and cement are apt to be formed from the same material; also the shape of the "pebbles" is hardly pebble-like, neither are the "pebbles" true, brecciated fragments. Also, in certain types to be described later, the bioglomerates, the phenoclasts are obviously neither pebbles nor angular material. Their outline is as peculiar and distinct as is their origin. Thus we find all variations, from sand-like particles to pebbles and breccias, and all of them conspicuously distinct from the cement or ground mass.

CLASSIFICATION.

(See table on page 35.) The stratigrapher is primarily interested in the "sequence of events," as exhibited by the relative position of, and the structures and fossils within, the formations which he studies in the field. He must observe texture and structure as well as fossils—in short, he should be lithologist and structural geologist as well as paleontologist. What little the present day stratigrapher knows regarding the texture of the sedimentary rocks, he has acquired with the methods of the petrologist, methods largely developed for the investigation of the igneous or crystalline rocks. The petrographer studies his thin sections and classifies his specimens according to their macroscopic and microscopic textures and mineral contents; the resulting data, together with the structural details and occurrence of the rocks in the field, are used by the petrologist to build his classification of the igneous rocks and to promote his theories as to their history and origin. Thus, studies in "paragenesis" and "order of crystallization" within veins and hypothetical rock melts have resulted in our present knowledge, through facts and hypothesis, regarding the main, great division of the rocks which form the earth's crust. Microscopic investigation of the sedimentaries, and especially of the limestones, has not appealed to the petrographer. The supposed lack of variation in texture, and more or less homogeneous mineral composition, has failed to raise the same amount of interest in their classification and origin as in the igneous rocks. Even granting the fact that with the limestones are associated, in many cases, the relics of past floras and faunas, which should stimulate investigation as to the history of the rock's formation, yet, because of the inherent difficulty of proving anything by the microscope, the limestones have been little studied. The tendency has also been to neglect their macroscopic phenomena in the field, although enough data has now been collected to stimulate an interest in its application to causes and events. It may soon be possible to classify sedimentary rocks according to the sequence of formative events which they have undergone. Such a classification is very much to be desired, as it will eventually give us a Natural History of the sedimentary rocks. In this paper the attempt will be made to classify intraformational glomerates with the above facts in mind. Thus, all intraformational glomerates may be divided into two groups: *A*, those whose present structure is contemporaneous with their primary lithification; and *B*, those whose present structure is non-contemporaneous with their primary lithification. Again, under class *B*, the present structures may be either previous or subsequent to the primary lithification. We will examine the classification more closely when we discuss the mode of origin of each type. As stated before, field evidence strongly points to the fact that it is impossible to explain all intraformational glomerates by a single hypothesis. It has been suggested that the rapidly growing amount of data concerning the occurrences of such rocks makes it unwise to classify them all under the term *conglomerate*. This statement will be appreciated fully by those who have observed different occurrences in the field, or have even read the descriptions by the authors who have studied and described them. Laying aside for the moment the conclusions reached by each investigator as to the origin of the particular intraformational glomerates in his area, we may at least rely upon his attempt to describe what he has seen. Descriptions of intraformational glomerates are so varied that one is forced to the conclusion that the variations cannot all be the result of a single set of factors. The study of intraformational glomerates is largely a study of the phenoclasts which bring them so strikingly to the notice of the field geologist, and it is upon the size, shape, structure (if present), and composition of the phenoclasts that this present classification is largely made. The arrangement of the phenoclasts may be heterogeneous, unsorted, parallel, banded, radiate or edgewise. The arrangement, as well as the size, shape, structure and composition, of the phenoclasts is intimately connected with their origin and the depth of water under which they were deposited, the strength of tidal currents, if any, the topography of the sea floor, and character of the sediments. The presence of organisms in the slimy mud of the seas may also have proved a determining factor in their evolution.

CLASSIFICATION OF INTRAFORMATIONAL GLOMERATES.

A. Present structure contemporaneous with primary lithification.
- I. Shape of phenoclasts not dependent upon transportation and attrition.
  - *a*. Endolithic breccias (mud-crack breccias.)
  - *b*. Bioglomerates.
    - 1. Result of animal (?) activity.
      - (a) "Strephochetal" glomerates.
      - (b) "Wingia" glomerates.
    - 2. Result of vegetable activity.
      - (a) "Corosion" glomerates (formed by algae).
      - (b) Algal glomerates (formed from algae).
  - *c*. Gleitungsphenomene; sub-aquatic-gliding-deformation "conglomerates."
    - 1. Lacustrine.
    - 2. Marine.
- II. Shape of phenoclasts partially dependent upon transportation and attrition.
  - *a*. Stratified glomerates.
  - *b*. "Edgewise" glomerates.

B. Present structure non-contemporaneous with primary lithification.
- I. Present structure partially previous to primary lithification.
  - 1. Shape of phenoclasts entirely dependent upon transportation and attrition.
    - *a*. Limestone conglomerates.
    - *b*. Mixed conglomerates.
  - 2. Shape of phenoclasts not affected by transportation and attrition.
    - *a*. Cliff breccias.
- II. Present structure subsequent to primary lithification.
  - 1. Tectibreccias.
  - 2. Enterolithic breccias.
  - 3. Ice-formed breccias. Formed by
    - *a*. Icebergs.
    - *b*. Continental glaciers.
      - 1. Result of shove.
      - 2. Result of thaw.

ENDOLITHIC BRECCIATION, (see Grabau, p. 777).—Mud-crack breccias.

Mud cracks are found to be of much commoner occurrence in the Cambrian and Ordovician limestones than was formerly supposed. Where there was a shallowing of the Ordovician seas so as to permit intermittent periods of dessication, mud-cracks are well developed over wide areas, and for a stratigraphic distance of several feet. Apparently the conditions which allow of the formation of mud-cracks (see fig. 1) also postulate a slight variation in the composition of the limy muds originally deposited. Thus, a series of alternating layers, which have been successively cracked by dessication, when viewed at right angles to their plane of deposition, show a series of stratified brecciated fragments. It is interesting to note that where quarries have been opened in the Bellefonte section (at both the middle Beekmantown and Lowville horizons) so as to expose the limestone beds for some distance along both the dip and strike, great mud-cracked areas have been brought to view. The writer has seen a mud-cracked surface on the west wall of the quarries at Tyrone which was at least one-half an acre in area. Only the closest inspection, however, of the section across or at right angles to the dip will show any structure that might lead the stratigrapher to suppose that mud-cracks were present, and in such great abundance. When the filling of the cracks, or rather, the material surrounding the phenoclasts, is of a different colour or texture from that of the phenoclasts themselves, a stratified intraformational breccia often proclaims that its other name is "mud-crack." Thus, in a region such as that characterized by the Appalachian type of folds, where the rocks are usually observed at an angle of between 25 and 60 degrees, it is quite natural that mud-cracks and ripple-marks should be considered rare phenomena, except where exposed in quarries and road-cuts along the strike. The mud-crack zone may have a stratigraphic thickness of only 3 or 4 feet and yet extend along the strike a distance as great as that from Bellefonte to Tyrone (60 miles), or even farther. What the total area of such a mud-cracked surface might amount to is difficult to surmise. Owing to the fact that the dip of the limestones at Pleasant Gap, several miles east of Bellefonte, is considerably flatter than the dip of the same beds at the latter place, the writer has been unable to get, as yet, any exact data as to the geographical extent of this phenomenon, but all signs point to its being an exceptionally wide one.

In connection with this subject it might be well to mention a certain columnar structure observed and described by E. M. Kindle (5) in the Silurian limestone on Temiscouata Lake, in eastern Quebec. The occurrence of columnar structure in limestone is unusual, and very like basaltic columnar structure in general, "but the columns are perhaps less regular in the number of faces shown, five to seven being a common number."

(To be continued).

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AMERICAN INSECT GALLS.

BY E. P. FELT, ALBANY, N.Y.

American gall insects constitute an exceedingly interesting assemblage, representing at least five of the larger and better known orders. It is worthy of note that by far the greater majority of plant galls are produced by members of the dipterous family, Itonididæ, and the hymenopterous family, Cynipidæ. Of approximately one thousand insect galls listed, members of the above mentioned groups are responsible for over 90% (nearly 95%), with two pecies of the delicate gall midges producing deformations to every one of the relatively better known gall wasps. The plant lice or aphids come next in the number of species, though they would be outranked if the gall mites, the Eriophyidæ, were included in this discussion. The other gall-making Diptera, Hymenoptera, and the Hemiptera and the gall-making Coleoptera and Lepidoptera are, numerically speaking, of comparatively little importance.

The numerous gall midges show a diversity of taste not evidenced among the gall wasps. The more than 600 galls produced by the midges occur on plants belonging to 69 botanical families and 202 genera. There is no such specialization, as we shall see later, in the Cynipidæ. The larvae of 60 species of midges live at the expense of the Salicaceæ; 48 of these are found on *Salix*; 28 occur upon the Juglandaceæ, all but one infesting *Carya*; 37 attack the Fagaceæ (31 of these being upon *Quercus*); 52 species produce galls on the Rosaceæ, 23 on the Leguminoseæ, 18 upon the Vitaceæ, and 125 on the Compositæ. The most obvious concentration of species, aside from those mentioned above, is the 41 species reared from solidago and the 20 to be found upon aster. These figures are approximate, yet taken in connection with the great diversity in the structure of these small insect, indicate that this group has been able to maintain itself upon a great many different plants through a considerable physiological adaptability, and that the distinctness of the species has been established by relatively small modifications in structure.

The Cynipidæ or gall wasps present an entirely different condition so far as the relation to the flora is concerned. They attack plants referable to only six botanical families, and assignable to but eleven plant genera. There is, however, a most striking concentration in food habits, since a very large proportion of the more than 300 gall makers subsist at the expense of the Fagaceæ which, for this group, means the genus *Quercus*, the exact number in our list being 277, though this figure, like those above, is an approximation. Thirty species have been reared from the Rosaceæ, 21 (*Rhodites*) living at the expense of the genus *Rosa*. The other species referable to the Cynipidæ are scattered in their food habits, the most evident concentration, and this far from marked, being the 12 species reared from various Compositæ, the genera *Silphium* and *Lactuca* producing four and three, respectively. This marked limitation in food habits is accompanied, as might be expected, by a high degree of specialization in structure.

The Aphididæ or plant lice live on a great variety of plants, though the gall-making forms occur upon relatively few plant families and genera, the most evident concentration in food habits being in the genus *Phylloxera*, with its 29 species producing galls on *Carya*.

The nealy allied jumping plant lice or Psyllidæ present a similar condition in the genus *Pachypsylla* and its relation to the numerous types of gall occurring upon *Celtis*.

The occurrence of a number of galls produced by closely related insects upon food plants belonging to a genus or even species, indicates a physiological relationship, and some of these groups at least offer excellent opportunities for the investigator who would study the relation between the specific identity of gall makers and the galls they inhabit. It is undoubtedly true that marked diversity in gall structure usually indicates the work of different insects, though there is a possibility that variations in the structure of these deformities may be related to some extent at least, to the period when the infestation occurs; in other words, oviposition before the tissues have swoollen to any extent in the bud may result in a somewhat different deformation than if egg laying be delayed until the leaves are partly unrolled. There are a number of cases where apparently identical gall midges produce markedly different deformations in the same or closely allied plants, and we are inclined to believe that the time of infestation in relation to the development of the host may be an important factor as well as the part of the plant attacked.

There is still much to be learned about insect galls and their makers. Many new galls await description, and exact knowledge respecting the habits of gall makers is far from complete. Certain localities offer exceptional facilities for solving the unknown, and we would suggest to nature lovers that the local occurrence of numerous galls should be considered an invitation to enter a charming and delightful field of study.

THE BARN OWL NESTING IN SOUTHWESTERN ONTARIO.

By W. E. SAUNDERS, LONDON, ONT.

The Barn Owl (*Aluco pratincola*) has been known in Ontario only as a casual visitor, and I may, therefore, be excused in stating that I regarded with incredulity a letter from Mr. W. C. Armstrong, of Chatham, written on June 29, which told me that there was a nest of the Barn Owl containing six birds near there. However, when I telephoned him he was very positive, and as a result I took the next train to Chatham, and in the afternoon drove out to Charing Cross, where the young birds were in the barn of Mr. H. C. Hunter. To my surprise there were really six young Barn Owls, almost full grown and apparently full fledged. They were in a little pigeon house under the ridge of the barn, and as may be supposed, the floor, about seven by five feet, was well covered with pellets. The pellets from these young birds were of a peculiar flattened oval shape, and were remarkably uniform in character. They contained a remarkably small proportion of bone, possibly indicating extraordinary digestive activity. All the identified bones were those of the common field mouse, and the fur appeared to belong entirely to the same species.

Immediately on our appearance on the ladder they began to hiss in a manner that was to me entirely novel and surprising. All six birds made the noise together, and it resembled that made by escaping steam. I supposed they stopped to take breath sometimes, but as they immediately began hissing again I failed to detect them in the act. They were crowded together in a corner of the little room, and when after a while they stopped hissing, it reminded one of the habits of the frogs which call so frequently and continually, and then on the advent of an intruder cease calling altogether. That is exactly what the owls did, and after several minutes of continual hissing the silence when they stopped could almost be felt.

When we offered them a stick they attacked it with their beak, and occasionally struck at it with a foot, but they had not yet reached the age when the uses of their feet were properly appreciated. After a while a ildness seized four of them and they rushed around the room, and one went out through a small hole and flew away. Where he went to is still a puzzle, but no doubt his parents found him at night.

The old ones do not appear in the day time, but come towards evening with food, and they have always been silent ever since they arrived in February, the hiss being the only sound Mr. Hunter has heard from them.

The only recent record of these birds for Ontario was when two were taken, one at Pelee Island and one at the base of Point Pelee in 1914, and there are a few other records of the occurrence of the bird, but this, I believe, is the first nesting that has ever been reported.

SOME NOTES ON FOSSIL COLLECTING, AND ON THE EDRIOASTEROIDEA.

BY GEORGE H. HUDSON.

PART II.

(Continued from page 25.)

Bather's "Studies in Edrioasteroidea," which appeared in the Geological Magazine at different times from 1898 to 1915 inclusive, have now been collected into one volume and published by the author at "Fabo," Marryat Road, Wimbledon, England. In this reprint the dates and paging of the Geological Magazine have been retained, and our references will, therefore, apply to both the original papers and the reprint. As examples of thorough study of what specimens have to reveal, these papers are unexcelled. It is highly probable, however, that the specimens themselves lack structures they once possessed, and that such structures will yet be found, either in more complete individuals or in fragments. Before specifying what I believe will be the nature of such finds, let me give some instances of structure rarely preserved.

Of what he calls the "tubular pyramid" on Pentremites, Hambach says ("Notes about the Structure and Classification of the Pentremites,"; Trans. St. Louis Acad. of Science, Vol. IV, No. 3, p. 6): "The only species on which Dr. Shumard observed the same, was a specimen of P. *sulcatus*, Roemer. . . . .

It is so seldom found preserved, that in thirty years' collecting, during which time I collected at one locality more than 6,000 specimens, I found only two specimens having this cone-shaped body preserved." In his "Revision of the Blastoidea," (1903, p. 14), Hambach also calls attention to a structure "on the posterior side above the anal opening, on very well preserved specimens, a small proboscis about one-fourth of an inch in length, constructed of small hexagonal pieces, as shown in Figs. 6 and 7. To my knowledge it is the first time that such a body has been observed on a Blastoid. I found this appendix on *Pentremites conoideus*, and have now four specimens of it showing this, so far unknown, organ." When, however, Hambach finds the ambulacral area more or less roofed over with small cover-plates, he believes them to be "fragments of broken-up pinnulae," or "small ovulum-like bodies," . . . . "due to the oolithic character of the rock in which they are imbedded." In the latter case a true structure, rarely found, is apt to be cleaned away, because of a belief that it does not belong to the specimen. It is well here to emphasize the need of most careful scrutiny before any attempt to modify an exposed surface.

Of Blastoidocrinus it seems that the nearly perfect Valcour Island specimen is the only one ever found still retaining its large "apical plate," its prominent series of "wing plates," (which form above the cover plates and completely hide the latter from view), and its brachioles; yet *B. carchariaedens* is one of the common fossils of the Chazy limestone. Additionl examples might be given, but the above are sufficient to show that species may be abundant and the mass of collected material very great indeed, and yet valuable evidence be lacking as to morphology, function and relationship.

From certain resemblances between Blastoidocrinus and some genera of the Edrioasteroidea, and from an examination of the only mechanism apparently used by the latter for the function of food-capture, I am forced to conclude that certain genera now grouped by Bather in this order possessed brachioles, and that purposive search for these structures in additional material, and it may be very fragmental, will sooner or later reveal them. My belief is based on the following facts.

The Edrioasteroidea are closely allied to the Cystidea, and by many made an order of that class, as in the last edition of Zettel's Text-book of Paleontology (Eastman). Bather follows Billings in recognizing the marked characteristics of this group, but places it no higher than a class of the subphylum Pelmatoza, making it equal in rank to Cystidea, Blastoidea and Crinoidea. All these classes were feeders on minute or microscopic plant and animal forms of the plankton, or on equally small but perhaps more abundant forms living on the bottom. The collecting apparatus consisted of numerous small brachioles or pinnules which captured the living organisms by means of ciliated grooves, lined with viscous secretions, and protected by a series of minute alternating cover-plates. The material caught by brachioles or pinnules was passed into common covered ways leading to the mouth. The main streams became in time mere conduits, and the surplus water taken in with capture and used for conveyance was either gradually lost between the cover-plates or carried to specialized separating areas, where the water was sent to hydrospires and made to assist in respiration. With this manner of food getting it will readily be seen that the cover-plates nearest the mouth would tend to remain closed and to become permanently fixed, or the proximal portions of the food grooves might become subtegminal in position. In every case the extent of the collecting portion of the apparatus is proportioned to the needs of the organism, and to the abundance of minute organisms in its habitat. Deprive Crinoid, Blastoid, Parablastoid or Cystid of its pinnules or brachioles, and its larger or main covered food-grooves could no longer function. Now, we must ask ourselves these questions. If the Edrioasteroidea are Cystids they belong to a group that secured their food by means of brachioles; they were for the greater part fixed and sessile forms, and could therefore only feed on such passing organisms as they could capture; for their size they show no greater length of covered food-grooves than we find in Malocystites, which was an elentherozic form and a feeder close to the sea bottom. Why should the Edrioasteroidea have lost the inheritance of the collecting mechanism of their class, and how could they secure sufficient food without it? These are serious questions, and they are made no easier by raising the group to class rank, for even then every other class of their subphylum required and retained the fringing brachioles or pinnules.

If we compare Blastoidocrinus with Steganoblastus, the need for and probable possession of brachioles by the latter will become more evident. Both are stemmed forms, with similarly shaped body cavities, and with proportional surface areas, covered by large food-grooves. In Steganoblastus, a name suggested by Bather on account of the *closely covered* condition of the main food-grooves (1914, p. 193), we find "large covering plates," (loc. cit.) which form a prominent rounded arch over the groove" (1914, p. 200). "At the proximal end smaller plates may be intercalated along the middle line" (1914, p. 199, and fig. 5, p. 200), or "the medial suture in the proximal region becomes curved and interlocking" (1914,

p. 199), and "apparently immovable over the mouth region" (1915, p. 212). In Blastoidocrinus we have also a closely covered condition of the similarly placed main food-grooves. We have *large covering plates* which *arch over the groove*, and are rendered *immovable* over both *rays* and *mouth region* by a series of still heavier accessory plates, called by the author "apical or anal pieces" and "wing plates," though for the former the term supraoral would be perhaps more appropriate. These ossicles are figured in N.Y. State Museum Bulletin 107, plates 6 and 7. In Blastoidocrinus a specimen the size of Styanoblastus would have about 350 brachicles for a catching apparatus to supply its covered main food-grooves. Bearing now in mind the fact that both were stemmed Ordovician forms which lived in the Ottawa sea, we must appreciate the difficulties which arise if we deny brachioles to Steganoblastus. Why should a continued stemmed existence in a similar environment cause the loss of a specialized and efficient collecting apparatus, and leave only the five main ways to the mouth, and these still closely covered with covering-plates, immovable at least for the mouth region, and for the older portions of the rays.

There are other interesting points to be gathered from Bather's description in which *Steganoblastus* resembles *Blastoidocrinus*. "The very deep folding of the plates," (1914, p. 195), in adapical and interambulacral areas are in Blastoidocrinus due to plate growth or development over hydrospires. There is a "series of pores" between the outer ends of the floor-plates and "just below the attachment of the cover-plates" (1914, p. 198). "The pores between the floor-plates pass through into the thecal cavity" (1914, p. 199), entering hydrospires in both Blastoidea and Parablastoidea. "There is a cover-plate to each floor-plate, and so far as can be ascertained after prolonged preparation and study, the sutures between the cover-plates coincide with those between the floor-plates. Thus, the pores, which as already stated, lie just below the attachment of the cover-plates, open under the sutures as in *Edrioaster*" (1914, p. 199). Precisely this condition is to be seen in Blastoidocrinus (N.Y. Museum Bulletin 149, plate I, fig. 2).

Of the outer border of the food-grooves Bather says: "The suture between the cover-plates and the adambulacrals is flush, and the curve of the cover-plates passes over, though with a distinct bend, into that of the adambulacrals. The suture is not a straight line, but a series of curves, the convex outer edges of the cover-plates fitting into slight concavities in the adambulacral margin. The position and number of the axial ridges on this margin indicate that the original adambulacral elements coincided in number but alternated in position with the cover-plates, and therefore also with the floor-plates. This suture, then, is essentially a zigzag suture between two sets of alternating plates. In consequence of this arrangement one would expect to see along the edges of the groove, when the cover-plates are removed, a series of depressions or facets for the reception of the cover-plates. Unfortunately the edges have in nearly every case been worn enough to remove all trace of these very faint depressions . . . ." (1914, p. 200).

This rather lengthy quotation has been made to show that besides the cover-plates and floor-plates we have present in Steganoblastus a third series of morphological elements belonging to the food-groove. One must at once question if these are not likely to be homologous with the outer side-pieces of Blastoidea, and to function as do the latter in assisting in the support of brachioles.

We should note that the question as to how these five closely or immovably covered rays secured an adequate food supply is not the only question raised by a study of the form and surface of Steganoblastus. How did it perform the very essential function of respiration, is another and very serious question. We find ample provision in Blastoidocrinus and the Blastids in elaborate hydrospire systems. Steganoblastus must also have possessed such a system, and the presence of hydrospires is strongly suggested in Bather's figures 2 and 3 (1914, plate XV), where the floor-plates have been lost. A system of this kind however, presupposes the possession of brachioles.

In Edrioaster the branch channels which end in pores (Bather, 1914, p. 118) are bordered by double ridges, the innermost of which are regularly broken transversely. This structure, shown by Bather, 1914, plate XIV, fig. 3, while not so elaborate as that shown by Hambach in his "Revision of the Blastoidea," plate II, fig. 5, is yet suggestive of the latter, and is an indication of structure associated with the segregation of the more solid contents of the food stream from the water accompanying it. Bather seeks to derive the Asterozoa from the Edrioasteroidea (an exceedingly probable derivation), but in doing so injures his case by interpreting the pores of Edrioaster as podial openings—going so far as to sketch outlines of an ampulla and base of a podium, in 1900, p. 197, fig. 4. Primitive sea-stars possess no podial openings between the floor-plates. This fact is now emphasized by Spencer in his "Monograph of the British Paleozoic Asterozoa," part I, (1914).

Under the heading "Relations of Steganoblastus," Bather says: "The absence of brachioles, inferred from the lack of brachiole-facets and the presence of large cover-plates, proves that Steganoblastus is not a blastoid, not even one of the Protoblastoidea, as was at first supposed" (1914, p. 202). We must modify this statement. The presence of brachioles should be inferred from the presence of small bordering plates equal in number to the floor-plates, and in zigzag arrangement with them; from the manifest need for additional structures to assist in food capture and respiration; from the appearances noted suggesting hydrospires; and from the presence of cover-plates nearly as large and solidly fixed as in Blastoidocrinus, which does possess brachioles. The peculiar blastoid-like markings on the channels of the food-grove noted in Edrioaster may be added to this list, for they will probably be found in both Blastoidocrinus and Steganoblastus. Bather goes on to say: "Secondly, the structure of the subvective groove, with its floor-plates and cover-plates, and its pores between the floor-plates, is paralleled by Edrioasteroidea alone among Pelmatozoa, and in that class most closely by *Edrioaster*, though there are minor differences" (1914, p. 202). This statement cannot stand, for in the points enumerated *Steganoblastus* is paralleled by *Blastoidocrinus*, and both plates and pores no doubt functioned in a similar manner.

We have here a very definite problem to solve, and as we are more likely to find or notice that which first exists in the "mind's eye," a clear comprehension of the problem may lead to an early solution. This idea of a problem-phase in collecting is one we should carefully bear in mind.

Before closing the present paper a few remarks on "field notes" may not be out of place. It is sometimes desirable to know the position assumed by a form, either while living or during burial. With surface material the determination is easily made. In the case of the holotype of *Palaeocrinus striatus* Billings, we desired to know whether or not the flattening of the theca was normal. The varying degrees of weathering, and the cutting away of the under side to free it from its matrix showed that this specimen was buried with the flattened posterior side down. The bent in condition of that surface may then have been simply due to pressure after burial. (N.Y. State Museum Bulletin 149, p. 216-217). In the Valcour Island specimen of *Blastoidocrinus carchariaedens* Billings, a knowledge of the side down at death would assist in proving the respiratory function of the hydrospires and the condition of the growing inner edges of their folds, for fine muds were swept into these folds after the stem could no longer support the theca, and before death occurred. (N.Y. State Museum Bulletin 107, p. 114, and fig. 2 on p. 105). In Canadacystis emmonsi (Hudson), the rounded, protruding portion of the theca seems to have been an adaptation to secure stable equilibrium on the sea floor with arms and mouth uppermost. Most specimens of Malocystites when rolled on a table come to rest with the food-collecting field uppermost. That the theca in this species rested on the bottom is shown by the area over which arm extension did not take place, and in this portion of the theca the plates were the heavier, thus lowering the center of mass and securing stable equilibrium with this part down. Dr. Foerste (1914) believes that the slope of the bed or surface of attachment influences not only the form of the theca, in Agelacrinus, but also the bending of the rays; and Bather (1915, Geological Magazine, p. 261) says: "Here, as in so many similar cases, the field-collector and observers have not supplied the laboratory worker with the desired evidence." Not only has gravity left many an unread story of its influence, but even orientation has some important new items for us; for instance, see Patten, 1912 (Evolution of the Vertebrates) p. 377-379, and fig. 257, where much of the "mode of life" of Bothriolepsis is determined from the position of the remains of this genus as preserved in the beds near Dalhousie, New Brunswick. Orientation may also have much to tell the paleogeographer as to direction of stream flow and of tidal currents. It would be a very easy matter to mark collected material in the field with an arrow in its under surface, indicating north. There seems to be room yet for improvement in our purpose in going afield, in our judgment of the character of the material saved, in our marking the specimens when found, and in the character of our field notes. We must also bear in mind that there is much to be saved and gained through any guiding care or assistance we may give to those lovers of nature who belong to the generations that are following ours.

NOTE.

Mr. J. H. Emerton, of Boston, Mass., spider specialist, recently visited Ottawa and other points for the purpose of collecting spiders. During his stay in Canada he obtained a large number of different species, the collection of some of which extended the known range of distribution. Mr. Emerton is making a special study of Canadian spiders. Members of the Club interested in entomology could assist materially in such study by sending specimens from their immediate districts. If preferable, the Editor of THE OTTAWA NATURALIST would be glad to forward any material sent to him.

A PRELIMINARY PAPER ON THE ORIGIN AND CLASSIFICATION OF INTRAFORMATIONAL CONGLOMERATES AND BRECCIAS.

By Richard M. Field, Agassiz Museum, Cambridge, Mass.

(Continued from page 36.)

The author shows that in ground plan these structures are quite similar to mud-cracks, and that they may be accounted for by the excessive dessication of limy sediments or clay-like material which has been preserved above water level for a sufficient period of time to permit of an abnormal deepening of the surface mud-cracks. Should the spaces or cracks between successive layers of such columnated limestones become impregnated with a subsequent deposition of limy, or even sandy material, an interesting type of intraformational breccia would probably be formed.

Hyde (6) describes a peculiar limestone conglomerate from the so-called "fresh-water" horizon of the Ohio coal measures. He writes: "after complete evaporation and cracking of the limy surface, it is necessary to suppose that there was a submergence in order to account for the matrix of small fragments and shells in which the pebbles all rest. * * * * If, after the conglomerate was completely formed, the deposition of limestone had been resumed instead of a soft shale, the result would have been a typical intraformational conglomerate of a thinner type, in which the structure would probably have been so obscured that a detailed study would have been impossible, or only possible with a great amount of labour."

BIOGLOMERATES.

There is some evidence that certain intraformational conglomerates may have been formed partly by organic agencies. Their origin may have been the result of either plant or animal (?) activities, and furthermore, the organisms may have had either a direct or indirect structural influence. Certain so-called "limestone conglomerates" are supposed to be composed of fossil organisms. Thus, Seeley (7) describes conglomerates from the Beekmantown of the Champlain valley as having their pebbles formed from sponges, a new genus, which he called *Wingia*. Brown (8) describes certain conglomerates at Bellefonte as due to the action of lime-secreting algae. He notes how important the algae are as reef-building organisms to-day, and remarks that Lithothamnion-structure is easily obliterated by percolating waters so as to form a structureless limestone. He concludes: "It is freely admitted that in these pebble-like structures from the Cambrian and Ordovician limestones, no organic structure has been found sufficiently well preserved to prove conclusively that they are of algal origin, but their similarity to such structures now forming is very suggestive." In discussing the orientation of the edgewise conglomerates, he follows Hahn's and Grabau's theory that the deformation and regrouping is largely due to "submarine slumping." The "Strephochetal conglomerates" mentioned by Seeley (9) are probably not true conglomerates. Seeley writes (op. cit. p. 152): "The spherical or elongated masses breaking down from a weathering rock appear like rolled fragments or calcareous concretions, and such without doubt they are in many cases. Yet a careful study of these will disclose the fact that a portion of these nodular forms have definite structure." Thus, the stratigrapher is apt to be led astray by certain fossiliferous rocks, which, upon a macroscopic and hasty examination, have all the earmarks of a true intraformational conglomerate, but which really owe their structure to a certain type of organism included in them. It is possible, however, that true intraformational conglomerates may be formed by the activities of organisms. The writer collected an interesting specimen from the lower Beekmantown at Bellefonte, which would seem to suggest another mode of origin, but somewhat along the lines suggested by Brown. The specimen shows a narrow band of unstratified and peculiarly shaped phenoclasts (see fig. 2). The phenoclasts themselves are only slightly fossiliferous and are fine-grained, showing no definite crystal structure, and have peculiar and varied outlines. The interstices are filled with a cement largely composed of algae and the debris of small shells, the former preponderating. The shape of the phenoclasts and the presence of the algae in the cement would seem to show that the fine-grained, uncrystallized muds deposited in intermittent layers upon the sea floor were broken while still in a plastic state by the action of the algae. The processes of primary deposition of the limy mud, floculation, and redisposition of the "conglomerate mass" were practically coterminous with the primary lithification of the limestone under discussion. Sardeson (10) in discussing the pseudo-brecciated structure of the Ordovician limestones of Manitoba, originally described by Wallace (11), makes the following statement: "In the bed number 3, lumps, cakes and lenses of pure, light-coloured, fine-grained limestone lie isolated in a brown, fucoidal shale, and the evidence is then clear that the lime was originally deposited in lumps or masses. The lime quite certainly came mainly from the decomposition of marine algae in the manner lately described by Thomas C. Brown. Without entering into a discussion of the questions as to what plants and animals may have contributed to the limy deposit, or in what manner the lime was collected, it is sufficiently evident to me that something deposited lime in small and large masses. The lenses and lumpy patches of relatively pure lime in all parts of the Galena-Trenton frequently inclose fossil shells, etc., in a way to show that these limy bodies *were soft when deposited*; that is to say, they often partly inclose shells, stipes of graptolites, fucoids, etc., either in the manner of objects overflowed by soft lime or in the manner of objects partly sunken into such a soft deposit. Shells of Lingulae are found which had bored into them—and the boring, was done, of course, while they were not consolidated." Sardeson himself advances a rather ingenious hypothesis for the formation of "corrosion conglomerates" (op. cit. p. 276). He believes that the "fucoids" found in the shaly limestones associated with the conglomerates are the roots of a sea-weed, closely related to *Camarocladia*, and that because of the hardness of the sea-floor these roots are supposed to have been able to penetrate vertically but a short distance, and thus could be easily uprooted by the rafting of flotsam at the surface of the water. He concludes: "Since the conglomerates are found in limited horizons instead of throughout the beds or formations, their origin is to be attributed rather to catastrophies, such as rafts of sea-weeds, etc., * * * *." Here again we may have a true intraformational conglomerate formed by vegetable means.

GLEITUNGSPHEOMENE.

Sub-aquatic and sub-aerial-gliding-deformation or solifluction. Under the heading "Sub-aquatic, gliding deformation," Grabau (op. cit. p. 780) writes: "Offshore deposits of sediments on a gently sloping sea or lake bottom may suffer, from time to time, deformation of the surface layers through gliding or slipping down the gently-inclined sea floor. * * * The most remarkable fact about the gliding in Zug was that it took place on an average grade of 6% (3°26′), while the larger and more pronounced movement occurred on a grade as low as 4.4% (2°31′)). The material thus slid into the lake was *brecciated* (italics are the author's) and folded with overfolds, overthrusts, reversals of layers, excessive strata, etc., and furnishes an excellent guide to the interpretation of similar movement in the past." Under the heading "Examples of fossil subaqueous solifluction," (op. cit. p. 781), the author quotes numerous examples from the Cambrian to the Miocene, bringing out the interesting fact that the intraformational structures are to be found at all stages of the earth's history. He does not distinguish, however, between kinds of sediments in which these folds and *breccias* are developed, and whether or not they were formed under fresh or salt water. It is interesting to note that Hahn builds his hypothesis upon the observation of the movements and deformations of lake deposits and clays. Grabau, likewise, cites examples of deformation in the Miocenic marls of Oeningen. He shows two photographs of this clay folded in this way, in neither of which has the writer been able to observe any signs of true brecciation, or such brecciation as was supposed to have taken place in the formation of the edgewise conglomerates at Bellefonte, Gaspé peninsula, and Trenton Chasm. In short, the tightly closed and delicately delineated folds, so beautifully illustrative, are very typical of the subaqueous solifluction of clays. Whether or not this peculiar type of folding is to be found in limestones is open to question. The writer has observed such folds in clays and delta deposits, but he has not seen any signs of true brecciation. It is possible that many of the Pleistocene, and even older occurrences, may be of glacial origin, They appear to be rather typical of clay deposits and glacial rock flours. In the case of the Devonian examples of intraformational breccias from the Cape Bon Ami limestones of the Gaspé region, we have a contorted and brecciated bed made up of alternating layers of shale and limestone, which, as described, is similar to those found at Trenton Chasm. It seems a somewhat strange coincidence that while subaquatic solifluction is postulated as having taken place, in most instances, in a more or less homogenous type of deposit, that in such localities as Gaspé, Trenton Chasm and elsewhere it should be confined to that portion of the strata in which there is a variation in the constitution of the sediments deposited. Although the writer fully realizes that the above cited facts may not be fatal to any hypothesis regarding submarine-gliding-deformation, yet, as the evidence in these cases tends very strongly to prove an alternative hypothesis, it must be scrutinized with some care. Although some "edgewise conglomerates" may be due to submarine slumping, it is difficult to conceive that the majority of intraformational breccias are the result of this process. Certain of the intraformational glomerates are of wide geographic extent, and of great stratigraphic regularity, although of great thinness. It is perhaps easier to conceive of a more or less horizontal, mudcracked flat or tidal estuary than it is to conceive of a submarine slope, along which "slumping" had taken place regularly and evenly over a similar distance. Although it has heretofore been stated otherwise, the textures of the phenoclasts, in most of the stratified and unstratified glomerates examined by the writer, have been found to be slightly different from the matrix. This tends to show that the sediments forming the phenoclasts and the cement were not derived from the same horizon. It is only reasonable to suppose that this lack of homogenity between the phenoclasts and their cement is intimately connected with their history. The writer believes that subaquatic-gliding -deformation is undoubtedly a good theory to account for the production of intraformational phenomena, but that its application in the case of the intraformational limestone glomerates is, according to the present data, extremely limited.

UNSTRATIFIED AND EDGEWISE CONGLOMERATES.

Of all intraformational glomerates, probably the so-called edgewise variety is the most notable in the field. Edgewise glomerates are apt to have their structure well developed by differential weathering, and the striking arrangement of the phenoclasts has caused several students of the sedimentary rocks to offer an explanation as to their origin. Probably the two leading hypotheses regarding the origin of these special glomerates are those of Hahn, and Walcott, previously mentioned. The writer believes that certain edgewise conglomerates which he has seen owe the explanation of their origin to Walcott's theory, although it is possible that edgewise breccias may be formed under the conditions postulated by Hahn and Grabau. Certain thin-bedded glomerates whose phenoclasts are but slightly abraded, probably owe their origin to such conditions as those observed by Walcott (12) at Noye's Point, Rhode Island. "I noticed that when the tide went out before daylight, the layer of fine sand and mud, exposed to the dry wind and sun during the day, hardened, and that when the surface of the water of the incoming tide was broken by small waves, the hardened layer was lifted, broken into angular fragments and piled, in some places, to a depth of several inches; while in other places it was simply turned over and was very little disturbed. When much disturbed, the edges of the fragments were rounded, so as to give them the appearance of having rolled a considerable distance. In one instance, the ensuing out-flowing tide deposited a thin layer of sand and silt over the brecciated fragments." From these observations it is evident that should the same phenomena occur on a sinking shore line, glomerates of the character so often met with by the field geologist, would be formed. When there has been a special heaping or sorting of the phenoclasts by marine currents, we should expect to find true "edgewise conglomerates." It is conceivable that conditions suitable for the formation of such "edgewise conglomerates" would probably be more or less local within the whole disturbed zone —that is, that a typical arrangement of the phenoclasts might not exist throughout the intraformational glomerates. Walcott does not mention the possible effect of the scouring action of tidal currents upon a previously mud-cracked surface. A tidal flat whose sediments were composed of a limy mud, when dessicated, would, if disturbed by a subsequent and sufficiently powerful tidal action, yield a quantity of tough, not brittle, phenoclasts, which might be redeposited with little or no signs of attrition except at the edges. Ripple-marked and mud-cracked bars and flats are very apt, at the present day, to be dissected by shallow currents, and these channels should act as catch basins into which the phenoclasts derived from the mud-cracked zone are tumbled by the onrushing tide. Agassiz (13) noticed that the lime-mud deposited by the waves of Florida hardened within a few hours to such a degree that it made a ringing sound when walked upon. This scaly deposit becomes exceptionally brittle between tides, and might, under certain conditions of deposition, be broken up by the advancing waves and re-deposited in much the same manner as suggested by Walcott.

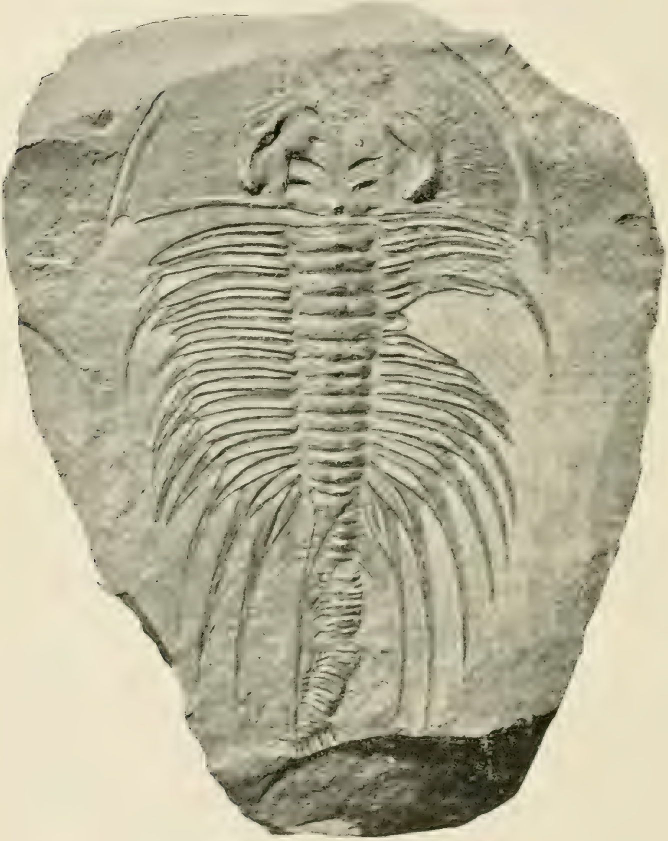
(To be continued)

NOTE.

The Editor of THE OTTAWA NATURALIST has frequently been asked, by members of the Club, for information on Nature Guide books. He has thought it advisable to list the pocket guides which are now available, and which may be obtained at The Book Store (A. H. Jarvis), Bank St., Ottawa, or from James Hope & Sons, Sparks St., Ottawa. These are as follows:

The Bird Guide—Land Birds
The Bird Guide—Water Birds
The Flower Guide
The Tree Guide
The Butterfly Guide
The Animal Guide

All of the above are beautifully illustrated in colours. They are invaluable to the nature lover, and in price are $1.00 each.



(Half natural size.)

Paedeumias robsonensis Burling
Lower Cambrian, British Columbia.

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PAEDEUMIAS AND THE MESONACIDÆ, WITH DESCRIPTION OF A NEW SPECIES, HAVING AT LEAST 44 SEGMENTS, FROM THE LOWER CAMBRIAN OF BRITISH COLUMBIA.(*a*)

By Lancaster D. Burling.

By common consent we are accustomed to regard the crustacea as derived from the annelids, and we have pointed to their abundantly segmented body as a reason for assigning this ancestorship to them. As late as 1915 (*b*) it was possible, however, to say that there are never less than two nor more than 29 segments in the thorax of a trilobite. Walcott (*c*) has recently described and figured a specimen with 42 normal segments. The specimen to be described contains at least 44 segments (the end is broken away), 29 of which are rudimentary segments posterior to a spine-bearing fifteenth. The great number of segments gives sufficient interest to this trilobite to warrant its description, and a discussion of its bearing on the evolution of the Mesonacidæ.

Paedeumias robsonensis n. sp.

Pædeumias n. sp., Burling, 1916, Bull. Geol. Soc. America, vol. 27, pp. 158-159.

Pædeumias n. sp., Burling, 1916, Geol. Surv. Canada, Summ. Rept. for 1915, p. 100.

Description.—Outline of the cephalon almost semi-circular, marginal rim relatively wide and flat, genal and intergenal spines distinct. Glabella crushed in front, but apparently parallel-sided and reaching in front to the marginal rim. Eyes prominent, broad at the anterior end, where they merge into and even cross portions of the glabella, and narrow at the posterior end which lies just within the posterior margins, is raised, and does not reach the sides of the glabella. Glabellar furrows deeply marked, four pairs being visible in the unmashed portion of the glabella described. The two posterior pairs are almost transverse, and extend two-thirds of the way from the dorsal furrow to the centre of the glabella; the third pair, counting

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(*a*) Published by the permission of the Deputy Minister of Mines.

(*b*) Schuchert, Pirsson and Schuchert's Textbook of Geology, 1915, p. 606.

(*c*) Smithsonian Misc. Coll., vol. 64, 1916, p. 162, pl. 26, figs. 4b, 4c.

from the back, is represented on either side by a dimple situated midway between the side and the centre of the glabella, and midway between the furrows anterior and posterior to it. The glabellar furrow nearest the front is a short diagonal groove starting just back of the point of union between the anterior end of the eye lobe and the glabella, and occupying the central portion of the distance from the side to the centre of the glabella. Surface of the cephalon an irregular network of raised inosculating lines more or less radial to the outer margin. Pleurae of two distinct types, an anterior normal set of fourteen and a posterior rudimentary set of 29 (or more, the end is broken away) separated by a spine-bearing segment. The ends of the first fourteen ribs become progressively longer toward the posterior end of the trilobite, and the fourteenth pair almost surround the rudimentary 29. These are further protected by the spine on the fifteenth segment, which is likewise extended. The rudimentary ribs differ little in width of axis from those which precede them, but the sides are very small. Pleural grooves broad, flat, and almost parallel-sided in those forming the middle portion of the trilobite. Toward the spine-bearing fifteenth segment the pleurae become relatively much wider for their length, and the pleural groove cuts more and more diagonally until in the thirteenth and fourteenth it cuts directly across from the anterior inner corner to the posterior outer corner. Rudimentary segments almost plain, pleural grooves being indistinct or wanting. The taper to the 29 rudimentary segments which have been preserved is so gradual as to render it extremely probable that there were many more than 29 segments anterior to the pygidium.

The fourth, fifth, and sixth pleurae on the right side of the specimen described have suffered injury, being broken off close to the axis at such a time or in such a manner that the ends have healed, and show a tendency toward a normal termination. The fifth one in particular is broken clear across, and in it the pleural groove stops just inside of the newly curved margin; the fourth and sixth were broken across transversely so as to leave the greater portion respectively of the upper and lower margins. This particular trilobite is as large or larger than the largest that has so far been discovered in the Lower Cambrian of British Columbia or Alberta. If we assume that the accident occurred during the youth of the trilobite, we must grant that these early forms did not have the power of renewing broken or lost portions, but this conclusion is negatived by its ability to heal up the broken ends and fashion them off. The accident was, therefore, probably of recent occurrence. And since it must have happened during his maturity, we are somewhat justified in assuming that our trilobite lost this portion of his anatomy to a foe more voracious, if not larger, than himself. The occurrence certainly lends weight to the inference that the Lower Cambrian trilobite was not the supreme arbiter we have supposed him to be; however, he may have been struck by material dislodged from a ledge beneath which he was crawling.

Horizon and Locality.—Lower Cambrian, Mahto formation, collected from drift block on the slope of the Mural glacier just under Mumm Peak, Mt. Robson region, British Columbia. Collected by E. C. Annes.

OBSERVATIONS.—*Paedeumias robsonensis* differs from *P. transitans*—the only other species known—(*a*): (1) in having 29 instead of 2 to 6 rudimentary segments posterior to the spine-bearing fifteenth, and in the more highly developed character of the rudimentary segments—they are better described as small short ribs in *P. robsonensis*, while those of *P. transitans* are truly rudimentary; (2) in having a highly ornamented cephalic surface; (3) in the character of the glabellar furrows, which approach closely to those represented in the cephalon from Mt. Stephen, B.C., doubtfully referred to *Olenellus gilberti* by Walcott (*b*); and (4) in the width and flatness of the marginal cephalic rim.

Paedeumias robsonensis resembles *P. transitans* in general shape and outline, in the number and general character of the normal segments and the pleural furrows, and in the abruptness of the change from regular to rudimentary segments.

These resemblances seem to warrant the inclusion of *Paedeumias robsonensis* in the genus *Paedeumias*, but the differences are such as to justify its reference to a new species. The specific name *robsonensis* is derived from Mount Robson, in whose general vicinity this trilobite was secured.

GENERAL CONSIDERATIONS.—The resorption of segments posterior to the fourteenth or fifteenth in the genera of the Mesonacidæ (a family of trilobites apparently confined to the upper portion of the Lower Cambrian) would seem to indicate that the functioning parts, those necessary for the life of the individual, were confined to the first fourteen. Once this adaptation to fourteen vital segments is made, and *Wanneria* appears to show the trilobite at the moment this took place, resorption of the remainder begins. The finding of 29 rudimentary posterior segments would seem to indicate that this resorption takes place laterally, that is, they become smaller in size before

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(*a*) Walcott, Smithsonian Misc. Coll., vol. 53, 1910, pp. 305-310, pls. 24, 25, 32, 33, 34 and 44.

(*b*) Smithsonian Misc. Coll., vol. 53, 1910, pl. 36, fig. 16.

they become fewer in number. Of known genera of the Mesonacidæ, *Mesonacis* and *Paedeumias* have a spine-bearing fifteenth segment, and the progression from the rib-like fifteenth segment of *Mesonacis* through the more rudimentary fifteenth segment of *Paedeumias robsonensis*, and the almost telson-like segment of *Paedeumias transitans* (which cuminates in the telson of *Olenellus*) is paralleled by the progression from the rib-like posterior segments of *Mesonacis* to the less rib-like segments of *Paedeumias transitans*. Moreover, the close relationship of the three genera is shown by the fact that in each the third segment is enlarged. That the number of rudimentary segments alone bears little or no relation to the relative primitiveness of the form is indicated by the fact that *Mesonacis*, which is clearly more primitive than *Paedeumias*, has less than one-third the number of rudimentary segments. *Nevadia*, which appears to be the most primitive as well as the earliest of the Mesonacidæ, does not seem to have reached the stage where differentiation of its segments might take place. In it there is a steady progressive decrease in the length of the pleural groove from the first to the eighteenth, with from six to eleven posterior segments whose pleural portion is unmarked.

In *Elliptocephala* the five segments posterior to the anterior thirteen (not fourteen as in the *Mesonacis-Paedeumias-Olenellus* line) are all spine-bearing, and are identical in everything but size. This feature has only been described for one other form, namely, *Redlichia chinensis*, and while the posterior five segments in this species are spine-bearing and do not otherwise differ from those anterior to them, we have no information as to the number of the anterior segments. It is at least 12 (*a*), however. In *Wanneria* there is a tendency toward nodes or spines on the anterior thirteen segments, and the fourteenth bears a short spine, but except in this respect it is indistinguishable from the progressively smaller segments posterior to it. In this genus there is no suggestion of a resorption of segments, and it seems natural to suppose that *Holmia* may have been derived from it since that genus also betrays no tendency toward resorption, and the anterior fourteen segments only of the sixteen bear spines. In neither *Holmia* nor *Wanneria* is there any enlargement of the third segment.

The fact that there is no enlargement of the third segment in *Nevadia* corroborates the indication given by the character of its ribs, and appears to justify us in believing it to be very primitive. The general resemblance between this genus and species of *Callavia* such as *eucharis* and *perfecta* (*b*) is worthy

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(*a*) Walcott, Research in China, vol. 3, 1913, pl. 24, figs. 1, 1a.
(*b*) Walcott, Smithsonian Misc. Coll., vol. 57, No. 11, 1913, pl. 53, figs. 1 and 3.

of note. *Schmidtiellus mickwitzi* (Schmidt) (*a*), with its thirteen segments, absence of any enlargement of the third, and the presence of a spine on the eighth segment, is clearly distinct from *Mesonacis*, but its relationships are obscure. Of the genera in which there is no tendency toward resorption (*Wanneria*, *Holmia*, and *Callavia*), *Callavia* (*b*) alone shows a tendency toward an enlargement of the third segment. The genera showing resorption (*Mesonacis*, *Paedeumias*, and *Olenellus*) all have an enlarged third segment. This is also true for *Elliptocephala* (*c*), though the differentiation between the third and other ribs disappears in this species in the adult. In *Olenelloides* (*d*), a bizarre survivor of Mesonacidæ, the third segment is enlarged.

The enlargement of the third segment appears to be important from a morphological standpoint, and it is preserved among Middle Cambrian trilobites bearing relationships to the Lower Cambrian Mesonacidæ in the youthful forms of *Zacanthoides* (*e*), and the adult forms of *Albertella helena* (*f*). Its importance in the latter species is, however, largely negatived by the fact that in the very closely related *Albertella bosworthi* (*g*) it is the fourth segment which is enlarged. In both species the total number of segments is the same, seven, but the number of segments uniting to form the tail is larger in *bosworthi* than in *helena*. The second segment is enlarged in the young of the following species of *Paradoxides*: *bohemicus* Boeck, *inflatus* Corda, *lyelli* Barrande, *rugulosus* Corda, and *spinosus* Boeck. In *Hydrocephalus carens*, *H. saturnoides* and *Paradoxides pusillus* Barrande the anterior two segments are enlarged. In *Shumardia pusilla* (Sars) the fourth segment is large, irrespective of the number of segments between the fourth and the tail. In several species of *Cybele* it is the sixth pair, and *Cyphaspis barrandei* and *C. burmeisteri* are each characterized by the presence of a very long median spine on the sixth segment. In one species of *Illaenus* (*hisingeri* Barrande) it is the first. In *Bathynotus* it is the eleventh and last. Median thoracic spines have been described for the following Cambrian species: *Saratogia hera* Walcott (*h*), *Norwoodia tenera* Walcott (*i*), and *N. gracilis* Walcott (*j*). *Zacanthoides*, which has been mentioned as one of the two Middle

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(*a*) Moberg in Moberg and Segerberg, 1906, Kongl. Fysiog. Sâllskapets Handl., N.F., Bd. 17, 1906, p. 35.

(*b*) Walcott, Smithsonian Misc. Coll., vol. 57, No. 11, 1913, pl. 53, figs. 1 and 3.

(*c*) Walcott, Smithsonian Misc. Coll., vol. 53, No. 6, 1910, p. 269.

(*d*) Peach, Quart. Jour. Geol. Soc. London, vol. 50, pp. 669-670, pl. 32, figs. 1-6.

(*e*) Walcott, Smithsonian Misc. Coll. vol. 53, No. 2, 1908, pl. 3, figs. 5 and 10.

(*f*) Idem, pl. 2, fig. 8.

(*g*) Idem, pl. 1, fig. 5.

(*h*) Smithsonian Misc. Coll. vol. 64, 1916, pl. 35, fig. 3b.

(*i*) Idem, pl. 28, fig. 2d.

(*j*) Idem, pl. 27, fig. 2f.

Cambrian genera showing enlargements of the third segment, includes one species (*idahoensis* Walcott) (*a*) characterized by the presence of a long median spine on the fifth segment, and one species (*typicalis* Walcott) (*b*) in which the median spine adorns the eighth segment. This enlargement of certain segments is comparatively rare among the trilobites, and its further study should yield results of morphologic value. The foregoing can only be considered as a resumé of some of the facts which may contribute "to the observational basis of the ultimate discussion."

A PRELIMINARY PAPER ON THE ORIGIN AND CLASSIFICATION OF INTRAFORMATIONAL CONGLOMERATES AND BRECCIAS.

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(Continued from page 52.)

LIMESTONE CONGLOMERATES.

Intraformational conglomerates have been described which are more nearly related to conglomerates in the ordinary sense than those heretofore discussed. The phenoclasts (true pebbles in this case) of these conglomerates are usually of several orders of size, and all but the largest are water-worn, i.e., derived, by transportation and attrition, from indurated, angular material. The pebbles contain the same fossils as are found in the cementing material or ground mass, and thus the conglomerate is proved to be truly intraformational in time. Such conglomerates are of manifold occurrence. Walcott (op. cit. p. 34) describes one from a locality below Schodack Landing, Rensselaer County, N.Y. He writes: "It (the conglomerate) shows that the limestone pebbles, boulders and brecciated fragments were formed from a calcareous sediment sufficiently consolidated to be broken up and more or less rounded by attrition, and these collected to form a bed of conglomerates, the matrix of which is usually calcareous." Sometimes these glomerates are very coarse, and contain phenoclasts the size of boulders (two to four feet in diameter). Walcott describes such conglomerates from eastern Pennsylvania, and others from Tennessee, in Cook, Sevier and Blount counties. In one portion of the Cictico conglomerates, he states (op. cit. p. 38), some of the boulders reach

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(*a*) Smithsonian Misc. Coll., vol. 53, No. 2, 1908, pl. 3.
(*b*) Canadian Alpine Journ. vol. 1, 1908, pl. opp. p. 248, fig. 1.

a diameter of six feet. Regarding the origin of the coarse intraformational conglomerates, Walcott writes (op.cit. p. 39: "The relation of the bedded limestone to the subjacent conglomerates proves that the calcareous mud which was subsequently consolidated into the limestones solidified soon after deposition. This is shown by the presence of limestone with sharp, clear-cut edges. The presence of the conglomerates above the limestone beds, from some portion of which they were derived, leads one to believe that the sea-bed was raised in ridges or domes above sea-level, and thus subjected to the action of sea-shore ice, if present and aerial agents of erosion * * *." The mode of occurrence of these boulders, especially those in the limestone at Stone's Quarry, leads to the hypothesis that they may have been dropped upon the sea-bed from floating ice. No other explanation occurs to me that will account for the placing of them upon the sea-bed, so as to not disturb to any marked degree the sediment then accumulating."

MIXED CONGLOMERATES.

A very interesting type of conglomerate which might be classified under B, I, 1, is that described by Raymond (14) from the Lévis. "The Lévis formation consists mostly of shale, with zones of hard blue and light grey limestone, and thick and thin beds of limestone conglomerate. Neither the top nor bottom of the formation is known. * * * Very fossiliferous pebbles have been found in the conglomerates in the Lévis, and the fossils show them to be derived from strata of three geological ages. The pebbles are: 1st, Lower Cambrian; 2nd, Upper Cambrian or Lower Ordovician; 3rd, Beekmantown. Besides the limestone pebbles there are many of igneous rocks and quartzites, but they do not form nearly so large a proportion of the conglomerates as do those composed of limestone. These conglomerates also contain pebbles of the red and green shale and sandstone of the Sillery, thus proving that the Sillery is older than the Lévis, while the *presence of Beekmantown fossils in both pebbles and matrix* of the conglomerates shows that the Lévis is of the same age as the Beekmantown at Phillipsburg, Quebec." According to Walcott's definition these may not be considered as intraformational conglomerates, since the majority of the pebbles are apparently not derived from the strictly subjacent zones of the same formation. Since such a type is not interformational, and since it is intraformational in all other respects, except for the fact that its pebbles are not derived from the same formation, it is believed best to provisionally classify it under B, I, 1. In short, this type of clastic does not postulate any such condition of unconformity as that represented by a basal conglomerate. Deposition was continuous throughout Lévis time, as shown by the fossils, but the conditions governing the character of the sediments deposited were varied.

CLIFF BRECCIAS.

It is possible that certain intraformational glomerates whose phenoclasts are angular and not rounded are largely made up of cliff breccias. Certain of the unevenly graded glomerates as mentioned above may have had their larger and angular material derived from ridges or domes raised above sea level, as postulated by Walcott.

TECTIBRECCIAS.

For a full discussion of intraformational folds and breccias of tectonic origin the reader is referred to W. J. Miller's paper: "Notes on the Intraformational Contorted Strata at Trenton Falls." The writer's visit to this interesting locality convinced him of two important facts. Firstly, that the "contortions" and breccias had taken place most characteristically in zones where deposition of sediments had been varied and alternating. Secondly, breaking down of the folds was, locally, very pronounced; extreme overthrusts of the hardened or purer limestone layers resulting in the formation of edgewise breccias contained in a greatly crushed and squeezed but structureless mass of shale. It seemed obvious from a personal examination of this phenomenon, that the thin limestone bands must have been well indurated before they were brecciated, and that the interbedded, shaly limestones, because of their composition, took up the thrust in such a way as to show little or no contortions or folds, such as is shown in the stringers of brittle limestone contained within them. The general overthrust phenomena exhibited in the more massive beds of the Trenton formation and their association with the nearby Prospect fault, seem to point conclusively to the tectonic origin of the contortions and breccias. Intraformational breccias of this type are not to be confounded with Fault breccias or Crush conglomerates. They are to be expected in those portions of a formation which have undergone varied conditions of deposition and subsequent exogenic deformation. As intraformations they are interstratified with the formation in which they occur, and are never found in crosscutting position. It is also interesting to note that the phenoclasts of such glomerates should be of a different composition and texture from the matrix.

ICE-FORMED GLOMERATES.

It is possible that icebergs and glaciers may have featured in the formation of intraformational glomerates. The shoving force or push and drag of a glacier has been supposed to have produced folding and overthrusting in the partly consolidated Pleistocene clays which it overrode. A single case has been mentioned by Sardeson (15) in which the loosening of subjacent limestone strata consequential to glaciation, has produced a local brecciation. This case is not intraformational under Walcott's definition, as the beds in question are Paleozoic in age, but it is conceivable that the glaciation of certain surfaces might have produced true intraformational breccias. It has been supposed that the close and peculiar folding in certain Pleistocene clays and delta deposits is the result of "drag" by grounding icebergs. Whether or not these folds owe their origin to such a cause, it is probably doubtful if intraformational breccias could be formed in this way, owing to the peculiar consistency of the sediments. The argument here against brecciation as a result of intense folding and overthrusting is much the same as in the case of subaqueous-gliding-deformation in clay deposits.

CONCLUSIONS.

The attempt has been made in the foregoing pages to classify intraformational glomerates according to their possible as well as probable origin. It is fully realized that the classification is merely preliminary in its scope, and no attempt has been made to cover all the literature on the subject. The thesis has been to emphasize the importance of certain textures and structures, especially in limestones, and to suggest that their systematic study may lead to a more comprehensive view of the history of the seas from and under which they were deposited. Walcott was the first to define the difference between intraformational and interformational conglomerates. His paper is important as it deals with the origin and deposition of limestones, and points the way to a more careful consideration of unconformity and disconformity in the field. Wherever the stratigrapher finds a change in the structure of the zones, no matter how superficial such change may at first appear, he should be on his guard for a probable change in the conditions of deposition and all the attendant geological phenomena, which may hypothetically be the *cause* of such a change. It has been pointed out that the usual rock section, as exposed by streams and roads, is apt to give little or no evidence of important structural phenomena, such as ripple-marks, mud cracks, etc. Under certain conditions intraformational limestone glomerates are very difficult to detect in the field, owing to the more or less homogenous composition of the phenoclasts and cement. The relation of intraformational zones to fossiliferous zones is of great significance in the study of limestones, and it has been found

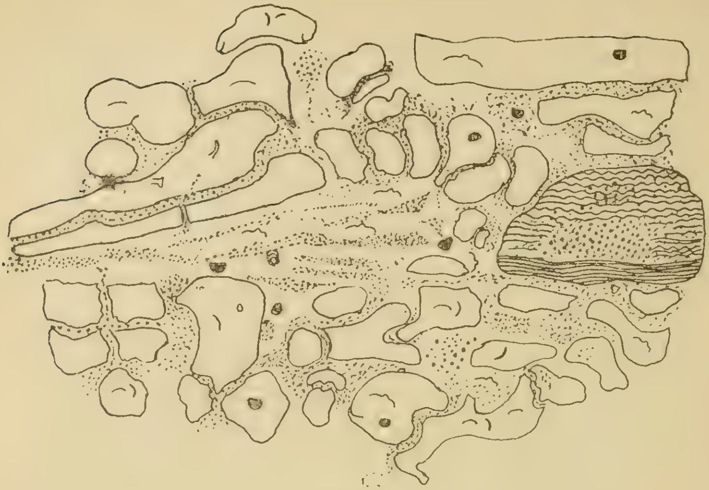

FIGURE 1.

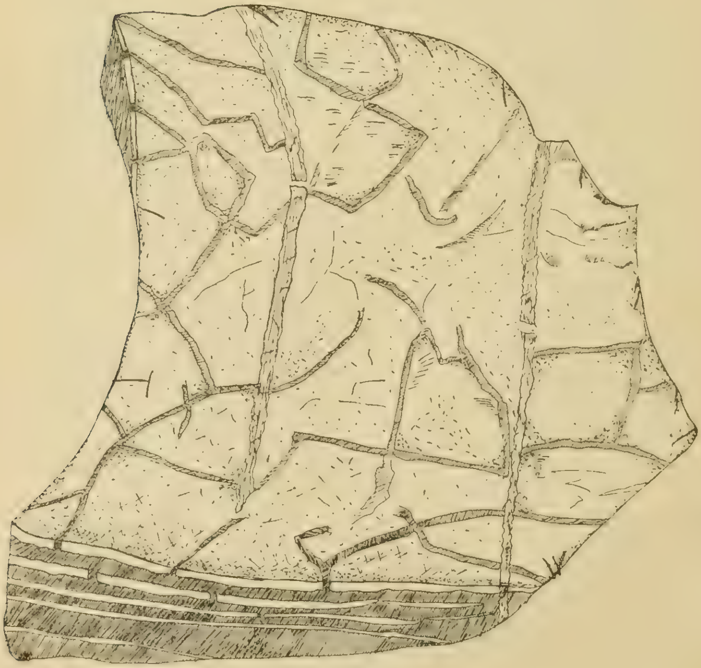

FIGURE 2

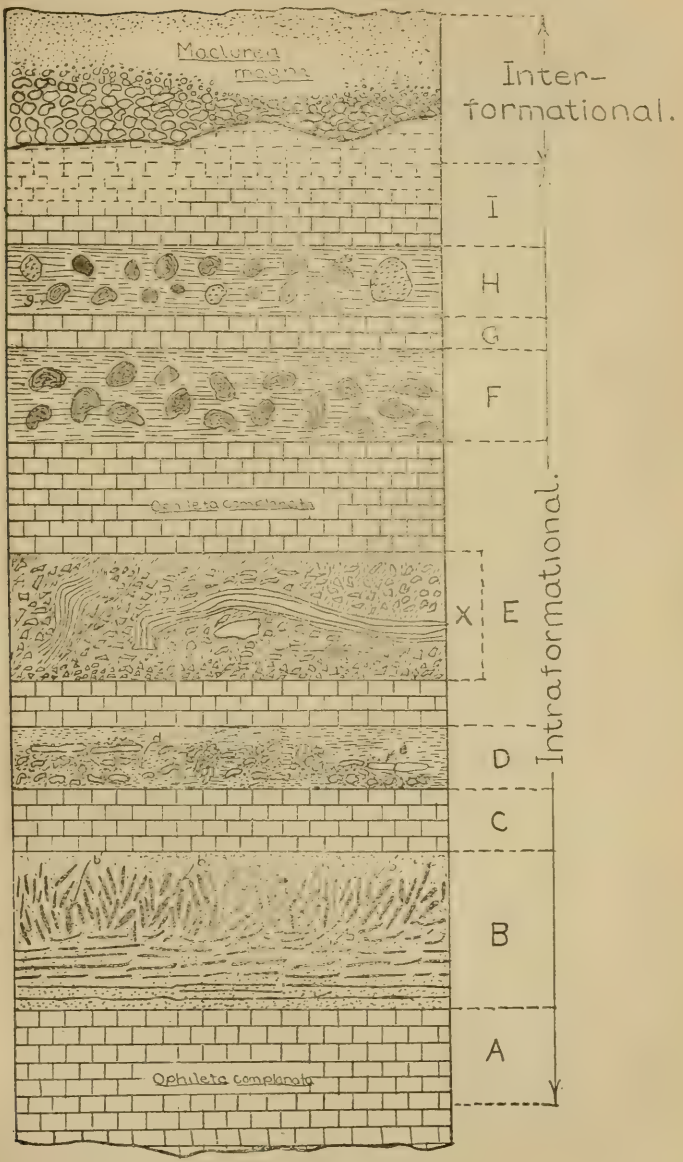
Maclurea magna
Inter-formational.
I
H
G
F
Ophileta complanata
X
E
Intraformational.
D
C
B
A
Ophileta complanata

FIGURE 3.

that it is sometimes a good deal easier to discover the fossiliferous zones in the Beekmantown than the glomerates subjacent to them. The study of intraformational glomerates includes a careful examination of the phenoclasts and cement as well as the structure and field relations of the strata above and below the zone in question. The examination of the texture, shape and composition of the phenoclasts and cement is mainly petrographic in its nature, and upon it will largely depend the plausibility of the students' views as to origin.

Certain liberties have been taken with Walcott's original definition of intraformational conglomerates. This was deemed necessary for two reasons: first, because some of the types discussed by Walcott are not typically conglomeratic (in the geological sense); second, because the term is such a useful and necessary one in stratigraphy that it should be applicable to an important group of clastics intimately associated with the history of the Paleozoic and Mesozoic seas. Whether or not it will ultimately be deemed advisable to group such rocks as tectibreccias, bioglomerates and edgewise conglomerates under the term intraformational is open for discussion. The attempt has been made to list and classify certain clearly, as well as obscurely, defined examples of limestones, with the hope that this systematic study may help in reaching the ultimate goal—the history and origin of the calcareous terrains of the world.

DESCRIPTION OF FIGURES.

FIGURE 1.—Diagramatic sketch of a supposed bioglomerate from the lower Beekmantown limestone at Bellefonte, Penna. The large phenoclast on the right hand side of the figure shows structure which may be organic in origin. Most of the phenoclasts present peculiar outlines not at all similar to the outlines of the pebbles in an ordinary conglomerate. The small dots are supposed to represent agal-like organisms which have worked their way into the soft limy material and broken it up into the characteristic shapes shown in the diagram. The phenoclasts are fine grained, and sometimes contain fragments of small fossils. Most of the fossils, however, are found in the more granular ground mass.

FIGURE 2.—This figure is illustrative of an actual specimen of mud-cracked limestone found in one of the quarries at Bellefonte, and illustrates on a smaller scale the phenomena exhibited on the east wall along the strike of the quarries from Bellefonte to Tyrone, Pennsylvania. The shaded lines on the surface, traversed by the two parallel calcite veins, represent mud-cracks. Viewed in section the structure is that of a typical stratified glomerate. The figure is supposed to illustrate the

two principal factors controlling the formation of such a glomerate:

1. Alternation of the conditions of deposition.
2. Dessication.

Figure 3 of this article is a diagramatic summary of the argument for a classification of sedimentary rocks, and especially of intraformational glomerates, according to the sequence of formative events which they have undergone. The figures are more or less diagramatic, and no attempt has been made to draw an accurate picture of each type. The reader may consult the various descriptions for accurate illustrations. Seven types of glomerates are represented in the columnar section, six intraformational and one interformational. In order to make the comparisons of the six intraformational glomerates relatively the more graphic, they are all supposed to have formed within a single formation, characterized by the index fossil *Ophileta complanata.*

Beginning with *A* time, we have deposition of pure limestone until *B* time, which commences with alternating depositions of pure and shaly limestone, followed by mud-flat conditions with dessication and the formation of mud-crack zones or stratified breccias. Here the phenoclast *b* is practically of the same age as the cement or matrix. During the rest of *B* time, marine currents are dominant and form edgewise glomerates, whose phenoclasts of the *b′* type have been carried a short distance and slightly abraded, so that they are slightly older in relation to their matrix than those of the *b* type. From the close of *B* time to the beginning of *D* time, pure, structureless limestone is laid down. During *D* time conditions are favorable for the formation of bioglomerates. Here again, as in the case of early *B* time, the phenoclasts are formed in place, and are practically contemporaneous with the cement. Through *E* we have a period of pure limestone deposition, except during the middle when shale was formed interstratified with the limestone. In *F* time we have the formation of a limestone conglomerate whose phenoclasts *e* are true water-worn pebbles derived from the subjacent zone *E*. Obviously the pebbles of this conglomerate were formed long before they were deposited, and long before the ensuing lithification of the mass. Compare the pebbles of this type with the phenoclasts of the preceding types. During *G* time there is a short period of pure limestone deposition, followed by a period characterized by conglomerates of the mixed type, certain of whose pebbles contain the same fossils as the cement (*Ophileta complanata*), proving that the conglomerate is truly intraformational in character. *I* time sees the close of the period characterized by *O. complanata*. Uplift and erosion result in a basal conglomerate resting with unconformity on older strata, and succeeded by sandstone and limestone in which occur *Maclurea magna*.

Long after the deposition and lithification of the formation described, and perhaps of several succeeding ones, tectonic forces cause the deformation of the sub-zone X in the zone *E*. Obviously the age of the phenoclasts in this tectibreccia is much younger than the ages of any of the phenoclasts heretofore discussed, whether they are intraformational or even interformational. Finally, it is a fact that not all the types described can be distinguished in the field at a glance. Type *X* may be easily confused with gliding deformation structures; type *D* with type *F*, etc.

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ANOTHER NESTING SITE FOR THE PRAIRIE WARBLER IN ONTARIO.

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The Prairie Warbler (*Dendroica discolor*) is one of the rarest and most casual migrant visitors to Ontario, and the only hint of a breeding station in this province was the one obtained when I found a few singing males near the tip of the Bruce Peninsula in 1900.

On the 14th of June this year I was at Port Franks (at the south-east corner of Lake Huron), in company with Mr. N. Tripp, of Forest. Early in the morning Mr. Tripp took me across the river to a region where he found two birds which he took to be Prairie Warblers, on June 14th, 1915, and as soon as we reached the locality we heard the characteristic song of this bird, consisting of ten or twelve very short notes, rising not more than two tones in the whole song, the notes resembling a wheezy whistle.

The location was within two or three hundred yards of the lake shore, where most of the surface was sand, with scattering vegetation, but the warbler was singing from an island of juniper, with a few white and red pines and birch, the mound rising to perhaps thirty feet in height, and the top of it being something like thirty or forty feet across. After watching him sing in a red pine at very short range, where he was feeding, he flew sixty yards to another similar island, where he sang again.

The next morning I investigated the locality more thoroughly, and found at least two other males singing, but nothing more was learned of their business in this locality, though the date is an acceptable proof that they were on their breeding ground.

The country along the lake shore for several miles each way is similar to that where these birds were found, and it is probable that extended investigation will disclose the presence of a breeding colony of some moment. On the west side of the river mouth, in a grassy marsh, were a number of pairs of the Short-billed Marsh Wren, but outside of these two species nothing rare was seen in the two days which I spent at the Port.

There were no White Throats, Juncos, Northern Thrushes, no Olive-sided Flycatchers, all of which are supposed to nest in small numbers in that district; nor did I find either Broad-winged nor Sharp-shinned Hawks, which were the object of the expedition.

The Yellow Lady's Slipper was growing near the Short-billed Marsh Wren colony, on the open prairie-like land, in exactly similar conditions to those under which I have found it on the Alberta prairies. The Blue-eyed grass (*Sisyrinchium*) was in thousands on the same territory, while in the shaded sand under the pine trees blue lupines occurred by the acre. White variants of the latter were common, and one such was seen of the *Sisyrinchium*. This district is a very interesting one to the botanist, and I have a feeling of fresh surprise on every visit to find the tulip tree and the red pine growing together. In the autumn of last year I visited this district, and was delighted in the great quantity of *Liatris* flowering in the woods. Owing to the fact that a great deal of the latter is wild, and also that cattle are absent, many unusual plants are found in comparative profusion.

BOOK NOTICE.

"CONSERVATION OF FISH, BIRDS AND GAME," issued by the Commission of Conservation. This volume is a report of the proceedings of a conference of the Committee on Fisheries, Game and Fur-bearing Animals of the Commission, and contains a fund of information regarding the present condition and the necessity for protection of Canada's fish, birds and mammals.

Canada is taking a prominent part in the international movement for the protection of wild life. A Migratory Bird Treaty between Canada and the United States is under consideration. Through the influence of the Commission of Conservation and other interests, bird reservations are being created, where the birds may find safe nesting and breeding places.

The fur-bearing animals of Northern and Western Canada are being rapidly exterminated. This is clearly shown by the present report. To secure their more adequate protection, the Commission is advocating the amendment of the Northwest Game Act to place responsibility for its administration upon the Dominion Parks Branch, which already protects the animals in the Dominion National Parks.

The future of the fisheries of Canada is dealt with in an able manner. That they are of great present value is recognized, but there is also a potential value in our oceanic and inland waters which, upon development, would mean the creation of new industries. To meet this condition the Commission is suggesting vocational training and simple demonstration stations for the fishermen, that they may take advantage of the most practical and modern methods of their calling.

The report is replete with illustrations applicable to the subject matter.

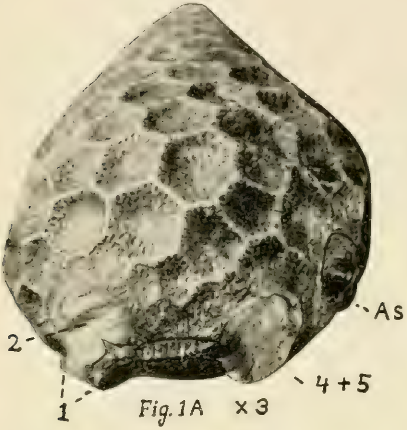
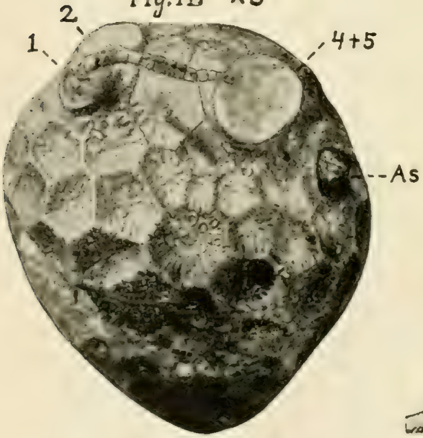


Fig. 1A ×3

Fig. 1B ×3



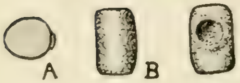


Fig. 3 ×3

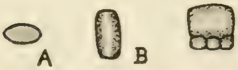


Fig. 4 ×6

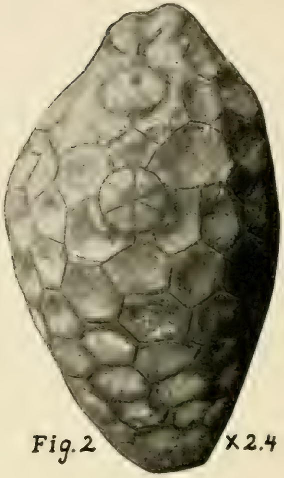


Fig. 2 ×2.4

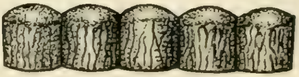


Fig 1C ×13

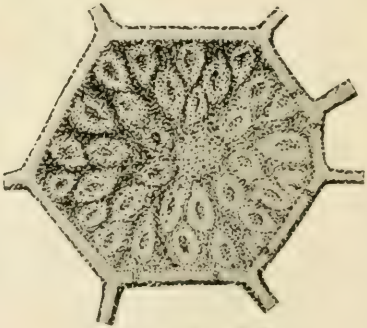


Fig. 1D ×8

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COMAROCYSTITES AND CARYOCRINITES

CYSTIDS WITH PINNULIFEROUS FREE ARMS.

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INDEX

I. PRELIMINARY REMARKS ON THE ARM STRUCTURE OF CRINOIDS AND CYSTIDS.

1. The origin of biserial arms.
2. Uniserial arms and pinnules in Comarocystites.
3. Biserial arms and brachiolar pinnules in Caryocrinites.
4. Biserial brachiolar pinnules in Stephanocrinus.

II. DETAILED DESCRIPTION OF COMAROCYSTITES PUNCTATUS BILLINGS.

5. Chief characteristics of the theca.
6. The numbering of the rays of the food-groove system.
7. The thecal plates bordering on the transverse apical food-groove.
8. The location of the hydropore.
9. The covering plates of the transverse apical food-groove.
10. The anal pyramid.
11. Fixity in the arrangement of the thecal plates limited to the immediate vicinity of the transverse apical food-groove and of the anal pyramid.
12. The arrangement of the basal thecal plates.
13. The structure of the thecal plates.
14. Sections across the anal pyramid and the transverse apical food-groove.
15. The arms of Comarocystites punctatus.
16. The pinnules.
17. The absence of food-grooves on the brachials.
18. The column or stem.
19. Geological horizon and geographical distribution.
20. Literature on Comarocystites punctatus.

III. DETAILED DESCRIPTION OF COMAROCYSTITES SHUMARDI MEEK AND WORTHEN.

21. Comarocystites shumardi.
22. The so-called variety obconicus.
23. The structure of the thecal plates.
24. Horizon and distribution.
25. Literature on Comarocystites shumardi and obconicus.

IV. GENERAL REMARKS ON COMAROCYSTITES.

26. The zoological position of Comarocystites.

V. ADDENDA.

27. Notes on Caryocrinites ornatus Say.
28. Acknowledgments.

I. PRELIMINARY REMARKS ON THE ARM STRUCTURE OF CRINOIDS AND CYSTIDS.

1. *The origin of biserial arms.*—According to Dr. F. A. Bather (Caradocian Cystidea from Girvan, 1913, p. 385), "the brachioles of Blastoids and Cystids differ from the Crinoid brachium, not merely in more fundamental features, but also in the fact that they are invariably biserial and present no trace of an anterior uniserial stage." The crinoid arm, on the contrary, is regarded by Bather (Echinoderma, 1900, p. 116), to have

originated from a uniserial form, even in those cases in which the arm structure at present is biserial, and diagrams are given illustrating how a uniserial arm might develop into a biserial one. It is well known that biserial arms frequently are uniserial at the base, and the arrangement here is regarded as more primitive. (See also Wachsmuth and Springer, Revision of the Palaeocrinidea, II, 1881, pp. 22-25; III, sec. 1, 1885, p. 14; III, sec. 2, 1886, p. 230.)

According to Austin H. Clark (A Monoograph of the Existing Crinoids, 1915, pp. 184, 189, 350, 352, 354), however, the biserial arrangement is more primitive in crinoids; the biserial arrangement being the palaeozoic type, while the uniserial arrangement originated chiefly in post-palaeozoic times.

Clark's conception of the origin of the biserial arrangement of the ossicles of crinoid arms is so different from that commonly accepted that it is quoted here in full:

"The crinoid arms are primarily paired interradial structures which have become joined along their radial edges, forming a radial biserial appendage, the ossicles later slipping in between each other so that an elongate uniserial appendage results. The original arms were, therefore, primarily ten in number. . . Originally, before their union into five, the arms probably bore no ventral ambulacral structures, and had no function other than that of increasing the surface of the disk by increasing the distance between the points of attachment." (Loc. cit., p. 350.)

The following statement by Clark also is illuminating:

"In such fossil forms as have biserial arms it is to be remarked that at the arm bases the brachials become uniserial; this is not to be interpreted as indicating that the arms were originally uniserial, but quite otherwise; mechanical considerations have forced the amalgamation of the two primitive radials into one, and similarly have forced the uniserial arrangement of the first two, and partially of the third and fourth, brachials." (Loc. cit., p. 354.)

"It is probable that the pinnules represent the original type of crinoidal appendage, and that these appendages were arranged in five pairs, the two components of each pair being, so to speak, back to back; but the pinnules have become enormously reduplicated, while in addition (they) have come to lie along either side of long body processes (arms) of subsequent development." (Loc. cit., p. 274, but omitting all references to cirri.)

Since the pinnules of crinoids are uniserial, it is certain that Clark regarded the uniserial arrangement of ossicles as primitive among crinoid appendages. Even the primitive arms of crinoids were imagined to have been uniserial. However, in times preceding the advent of the actually known paleozoic crinoids, adjacent uniserial arms were supposed to have united laterally in pairs in such a manner as to give rise, first, to biserial arms, and, later, to pseudo-uniserial ones. According to this theory, the pinnules of the theoretical uniserial arms might be arranged in a single series along one side of the arm, while the pinnules of the pseudo-uniserial arms should occur in two series, successive pinnules being attached alternately to opposite sides of the series of arm ossicles. If the food-groove along the ventral surface of the crinoid arms be regarded as originating along the line of junction of the two imaginary primitive uniserial arms, this food-groove might be retained in pseudo-uniserial arms originating from biserial forms, but need not be present in the imaginary primitive uniserial arms.

The views favored by Clark, and the various possible deductions from them, are interesting. They would be more interesting if they found support in the probable phylogeny of fossil species. It must be conceded, however, that in the earliest known representatives of the crinoids, the primary radials and primibrachs of Clark already were united laterally so as to present an initial series of five, instead of ten arms, as demanded by Clark's theory, and all the arms bear food-grooves. Moreover, even the earliest known biserial arms are more or less uniserial at the base.

2. *Uniserial arms and pinnules in Comarocystites.*

In the absence of anything corresponding to the supposed primitive arm structure of crinoids, among known Crinoidea, it may be interesting to note that, among the Cystidea, the free arms of *Comarocystites* are uniserial (Plate III), do not bear a food-groove along the ventral side, and support pinnules arranged in a single row along the right side of the arm (the ventral surface being directed away from the observer, and the distal end of the arm being directed upward); moreover, the pinnules consist of a uniserial row of ossicles. In a similar manner the uniserial row of plates supporting the recumbent food-grooves of *Amygdalocystites* (Canadian Organic Remains, III, 1858, plate VI), also might be regarded as uniserial arms, bearing a single row of uniserial pinnules along the right side of each arm. It is probable that *Canadocystis* (Bulletin 80, N. Y. State Museum, 1905, pp. 273, 274),had an arm structure similar to that of *Amygdalocystites*. It must be admitted, however, that these forms are not normal cystids. The possession of uniserial pinnules in *Comarocystites* and *Amygdalocystites* is sufficient to indicate this. *Canadocystis* probably also had uniserial pinnules. However, none of these genera could have given rise to five biserial arms, in accordance with the theory favored by Clark. At best *Comarocystites* could have given rise to only two biserial arms.

3. *Biserial arms and brachiolar pinnules in Caryocrinites.*

Caryocrinites (Plate IV) is anomalous in presenting brachioliferous free arms in which the ossicles of both the brachioles and of the arms are biserial in arrangement. It is anomalous also in other respects. Successive ossicles on the same side of the arm usually alternate strongly in size, the lower ossicle of each successive pair being distinctly shorter, sometimes, in fact, being reduced to a small, transversely cuneate remnant along the inner half of the horizontal suture separating the larger ossicles. When both of these successive ossicles are more nearly of the same size, both are in contact with the base of the same brachiole, the lower, shorter ossicle of each pair being in contact with one of the series of ossicles forming the brachiole, and the upper, longer ossicle of the same pair being in contact with the other series of brachiolar ossicles. Hence, it is possible to regard not only the arm of *Caryocrinites* as made up by lateral junction of two uniserial arms, but, in a precisely similar manner, the brachiole of *Caryocrinites* might be regarded as built up by the lateral junction of two uniserial pinnules, the supporting brachial ossicles of each of these theoretical uniserial pinnules still remaining distinct.

As a matter of fact, the brachioles of *Caryocrinites* may be diagrammed also as uniserial forms, the ossicles alternating in position from right to left, across the brachiole, the lowest ossicle at the base being regarded as the first ossicle of the brachiole.

4. *Biserial brachiolar pinnules in Stephanocrinus.*

Biserial pinnules are so anomalous among crinoids that in the case of *Stephanocrinus*, the only crinoid known to possess them, Wachsmuth and Springer identified them as pinnules. (Revision of the Palaeocrinidea, III, sec. 2, 1886, pp. 283, 284, 292), stating: "that these appendages, although they are equally thin and short, are not pinnules, is proved by the fact that all are supported by a radial plate, instead of being distributed separately along the sides of an ambulacrum." More recently (Zittel, 1913, p. 207) Springer has described *Stephanocrinus* as possessing "arms with one short biserial trunk to the ray, giving off slender biserial, non-pinnulate side arms from the outer shoulder of each brachial."

Evidently, *Stephanocrinus* is as anomalous among crinoids as *Caryocrinites* is among cystids.

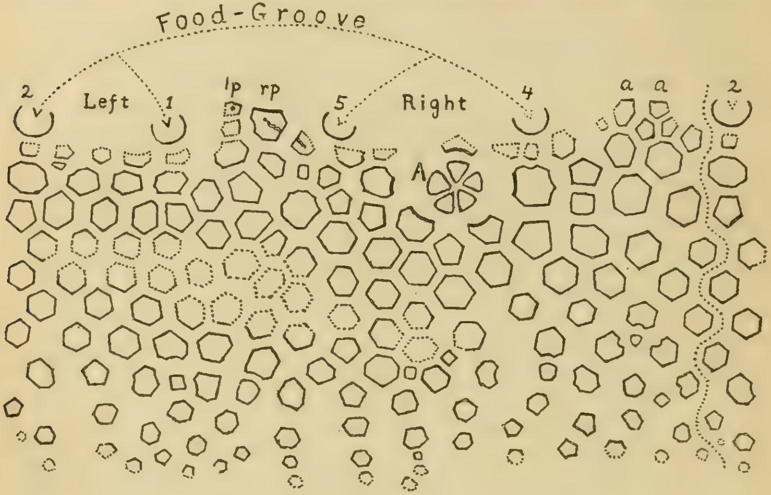
In presenting the preceding lines, there is no desire to favor the view that the biserial arms of crinoids have originated by the lateral junction of pairs of uniserial arms, but rather to call attention to the fact that the arms of certain cystids apparently present similar problems. Since these cystids are not as fully known as desirable, a more detailed description of *Comarocystites* is given here, and a few notes on *Caryocrinites* are appended. Moreover, these are the only cystids known at present in which the arms are free and pinnuliferous, and, as such, possess special interest. Both genera are American, occuring both in Canada and in the United States.

II. DETAILED DESCRIPTION OF COMAROCYSTITES PUNCTATUS BILLINGS.

5. *Chief characteristics of the thecă.* Theca obovate, sometimes attaining a length of 75 millimeters, composed of about 150 plates, most of which are hexagonal in outline. Theca moderately compressed from front to rear. The two primary food-grooves diverge toward the right and left from the mouth in such a manner as to present the appearance of a single transverse, slightly curved, food-groove (Plate II, figs. 1A, 1B). The mouth does not present the appearance of a slit, as in *Aristocystis bohemicus* Barrande, and apparently also in *Caryocystis angelini* Haeckel, but takes the form of a more or less circular or elliptical aperture located in the bottom of the transverse apical food-groove already described. At each end of this food-groove the latter branches dichotomously on the proximal side of a nodular protuberance of stereom about 10 or 11 millimeters in diameter. Each nodular protuberance supports two arms. There are, therefore, four arms, arranged in pairs, one pair at each end of the transverse apical food-groove. These correspond in position to the lateral arms of the five-rayed cystids, there being no arm corresponding to the anterior arm of other cystids. The anal pyramid (Plate II, figs. 1A, 1B, 2; also Plate III) is situated a short distance below the protuberance supporting the pair of arms on the right side of the specimen. In larger specimens the transverse apical food-groove, between the points of dichotomous branching, has a length of about 13 millimeters, thus giving to each of the two lateral primary rays a length of 6 millimeters. Throughout its length the transverse apical food-groove follows the suture line between the anterior and posterior peristomial thecal plates. Along the basal margin of the nodular stereom protuberance, the exterior surface of the adjoining thecal plates of some specimens presents the appearance of being crowded back by the growth of the protuberance, and consequenlty of being reduced in size. The upper margin of these thecal plates appears to rest against the lower half of the protuberance, but cross-sections of other specimens indicate that the upper inner margin of these thecal

plates extends sufficiently beneath the base of the protuberance to suggest the origin of the latter as an accessory stereom deposit upon the surface of the theca, necessitated by the demands for support made by the growing arms.

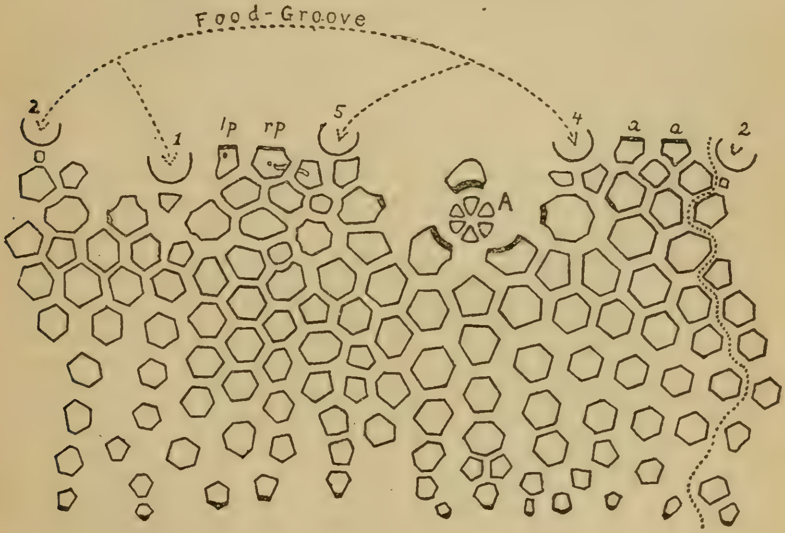
The degree of compression of the undistorted theca is moderate, the horizontal diameter from front to rear equalling about .80 to .84 of the lateral diameter. Specimens preserved in soft clay frequently present a much greater degree of compression, due to distortion after death. The length of the theca equals about ten-sevenths of the greatest transverse diameter.



Text figure No. 1. Diagram of the thecal plates of the specimen represented by figure 1 on plate II. The plates on the right of the vertical sinuous line on the right side of the figure duplicate those at the left margin of the diagram. The anterior peristomial plates are lettered *a, a;* the right and left posterior peristomial plates are lettered *rp* and *lp* respectively. The relative position of the different arm facets is indicated by the numbers *2*, *1*, *5* and *4*, explained in the text. The dotted line indicates diagrammatically the transverse apical food-groove which forks at each end, each branch leading to the base of one of the arms, the latter being arranged in pairs. The anal pyramid is indicated at A. The linear hydropore extends from the middle of plate *rp*, diagonally downward and toward the right, as far as the middle of the adjoining plate.

Viewed from a direction at right angles to the plane of symmetry passing vertically through the theca, and parallel to the transverse apical food-groove, the sides of the theca differ slightly in outline. On the anal side the outline is more angularly convex, the maximum convexity being near midlength. On the opposite side the maximum convexity tends to be distinctly less curved. This difference in outline evidently is due to the location of the anus which has been dragged sufficiently by the gut to reduce the convexity of the upper part of the theca along its outline on the right, thus lowering the point of maximum convexity on this side.

6. *The numbering of the rays of the food-groove system.*—There is no trace of an anterior ray of the food-groove system in *Comarocystites*. However, it is possible to number the arms present in such a manner as to make comparisons with the rays of cystids whose food-groove system shows evidence of pentameral symmetry readily possible. (Plate II; figs. 1A, 1B; also text diagrams 1 and 2).



Text figure No. 2. Diagram of the thecal plates of the specimen represented by figure 2 on plate II. All letters and numbers as in text figure No. 1. That edge of the thecal plates which is in contact with the anal pyramid is heavily blackened. That edge of the basal plates which is in contact with the column is blackened in a similar manner.

In that case the left posterior arm is numbered 1, the left anterior arm, 2; the right anterior arm, 4; and the right posterior arm, 5. The absence of an anterior ray is indicated by the omission of the number 3.

7. *The thecal plates bordering on the transverse apical food-groove.*– If the thecal plates bordering on the transverse apical food-groove be termed peristomial plates, then the anterior side of this food-groove (Plate II, fig. 1A) may be described as bordered by two peristomial plates sufficiently similar in width to place the intermediate suture-line about half-way

between the ends of the transverse food-groove. It is evident that if an anterior ray ever was present in any of the ancestral forms leading to *Comarocystites*, this ray may have rested on the suture between the two anterior plates (between plates a, a, of the text diagrams) here under discussion. The outline of the right anterior peristomial plate is more or less obliquely hexagonal, while that of the left anterior peristomial plate is pentagonal.

The posterior side of the transverse apical food-groove also is bordered by two peristomial plates (Plate II, fig. 1B; also thecal plates lp and rp in text diagrams), of which the right is so much larger that it forms about two-thirds of this posterior border. The general outline of this plate is hexagonal, but the apex of the angle on the left side is broadly truncated by a concave curvature, as though three plates were in contact with the left margin of this plate:—a large, more or less hexagonal plate along its lower left margin, and two more or less quadrangular plates in contact respectively with the middle and upper parts of this left margin. The line of contact between these two quadrangular plates is not defined distinctly in any of the specimens examined, but the upper one of these plates borders on the left third of the transverse apical food-groove, and may be described as the left peristomial plate.

8. *The location of the hydropore.*—The orientation of the cystids is determined, not by the location of the mouth and anus but by the vertical plane passing through the mouth and hydropore. The hydropore is regarded as occupying a position directly posterior to the mouth. In *Comarocystites* the only surface structure suggestive of an entrance to a hydropore is a narrow, sinuous, almost linear ridge, extending from the middle of the right posterior peristomial plate (Plate II, fig. 1B; also thecal plate rp in text diagrams), across the suture on its lower right-hand margin, to the middle of the adjoining plate. The upper margin of the latter plate is in contact with the posterior margin of that nodular stereom protuberance which supports the right pair of arms. Along the top of the narrow, linear ridge there is a very narrow, faint groove, suggesting the presence of a narrow slit-like opening. Whatever the homology of this ridge, it evidently locates the posterior side of the theca. In several specimens there is a minute pit just beyond the upper left-hand termination of this hydropore ridge; however, since it was not observed in the majority of specimens, it cannot be determined definitely as a gonopore.

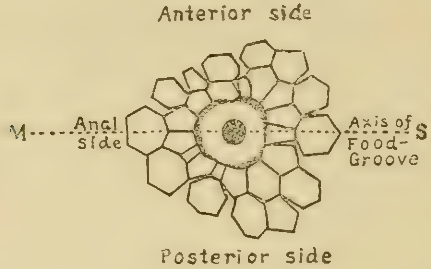
Nothing suggesting a hydropore is known at present in *Amygdalocystites*. In *Canadocystis emmonsi*, however, G. H. Hudson (N.Y. State Museum Bulletin 80, 1905, pp. 273, 274) has figured a possible madreporite at the posterior end of the suture between the two posterior peristomial plates making it possible to orient this species in the same manner as *Comarocystites* with the anal pyramid on the right side of the theca.

9. *The covering-plates of the transverse apical food-groove.*—The transverse apical food-groove is covered by two series of quadrangular covering-plates (Plate II, figs. 1A, 1B, also C), one on each side of the food-groove. These plates meet along the middle line of the food-groove so as to form an acute ridge. They are ornamented by minute granules similar to those of the adjacent thecal plates and there also is a tendency toward a low elevation along the median line of each covering plate. About five covering-plates occupy a length of 3 millimeters along the food-groove. In one specimen 8 or 9 covering-plates occupy the entire distance along the unbranched part of the food-groove, and 3 or 4 covering-plates line each side of that short branch of the food-groove which leads from the left end of the food-groove to the base of the left posterior arm. In another specimen about 15 or 16 covering-plates occur on each side of the unbranched part of the transverse apical food-groove, and 3 or 4 covering-plates line each side of the branches leading from the left end of the food-groove to the bases of the left anterior and left posterior arms.

10. *The anal pyramid.*—The number of plates exposed in the anal pyramid (Plate II, fig. 2; also A in the text diagrams) varies in different specimens from 5 to 6. The general form of the pyramid is semi-globose, but the apical part is more or less flattened. In all of the specimens examined, the anal pyramid is bordered by 5 thecal plates. Of these, two plates form the lower border, one plate occurs on each side, and the fifth plate forms the upper part of the border. The plate on the right side of the pyramid always is larger than the rest. The upper margin of the plate forming the upper border of the anal pyramid is overlapped on each side by a narrow plate separating the latter from direct contact with the base of the nodular stereom protuberance supporting the right pair of arms. The sutures of these overlapping plates often are indistinctly defined. That part of the thecal plates which borders directly on the anal pyramid is smooth, and moderately elevated.

11. *Fixity in arrangement of thecal plates limited to the immediate vicinity of the transverse apical food-groove and of the anal pyramid.*—Evidently there is a considerable degree of fixit in the number of thecal plates bordering on the transverse apical food-groove and in the number of those surrounding the anal pyramid, and there also is an approximation toward fixity in the general outline of these plates; but this fixity in number,

position, and outline usually is absent among those thecal plates not bordering on the transverse apical food-groove or on the anal pyramid. However, certain tendencies may be observed even among these other thecal plates. For instance, the plate directly below the middle of the anal pyramid (Plate II, fig. 2; also text diagrams), but not in contact with the latter, is pentagonal in form, and has its upper angle inserted between the two plates forming the lower border of the pyramid. Directly beneath this pentagonal plate is a series of hexagonal plates which, instead of forming a strictly vertical row, are arranged along a line which curves moderately toward the front on approaching the base of the theca. Parallel to this series of plates, on its anterior side, are similar series of hexagonal plates, causing the anterior side of the theca to present the appearance of diagonally intersecting rows, with the angles of the thecal plates directed toward the top of the specimen. On the posterior side of the theca, a similar tendency toward the arrangement of plates in rows causes one of the sides of the hexagonal plates, rather than one of its angles, to face the top of the specimen.



Text figure No. 3. The two lower series of thecal plates of the specimen represented by text figure No. 2, and by figure 2 on plate II; drawn as though viewed from the lower side and oriented as indicated in the diagram. The vertical projection of the plane passing through the anal pyramid and parallel to the transverse apical food-groove is indicated by the dotted line. The dotted parts surrounding the top of the column indicate the extent to which the basal part of the lowest series of plates rises above a line drawn strictly horizontal around the top of the column. The dotted area at the center represents the lumen. Fifteen plates occur in the basal series of thecal plates in the specimen diagrammed, but the number varies greatly in different specimens.

12. *The arrangement of the basal thecal plates.*—The outline and arrangement of the basal thecal plates, where in contact with the stem or column, varies from 11 to 15 (Text diagram No. 3) in different specimens. The line of contact between the basal thecal plates and the top of the column is not strictly horizontal, but rises and falls in an irregular manner, varying

in different specimens. All efforts to diagram the basal thecal plates of *Comarocystites punctatus* in such a manner as to secure a primary series of 3, 4 or 5 plates has failed, nor is it possible to demonstrate the presence of any radial plan of arrangement of the lower thecal plates, extending outward from a supposed primary basal series.

If any increase in the number of plates forming the theca takes place in any except the earliest stages of growth, this increase in number can take place only at the base of the theca, where in contact with the column. Elsewhere the plates of the theca are almost uniform in size. The series of plates in contact with the column, however, frequently are unequal in size, smaller plates not infrequently being wedged in between larger ones, and the line of contact between the margin of the lowest plates and the top of the column is more or less irregular.

EXPLANATION OF PLATE II.

Fig. 1. Comarocystites punctatus Billings. Specimen belonging to James E. Narraway. A, anterior side, photographed so as to show the thecal plates nearest the transverse apical food-groove, and coverplates on the anterior side of the food-groove; also the position of the anus and of the masses of stereom supporting the two pairs of arms. Several of the plates give distinct indications of the pairs of lunate pores which occur directly beneath the epistereom. B, posterior side, photographed so as to show the thecal plates along the upper half of the specimen, the cover plates on the posterior side of the food-groove, and the linear hydropore passing from the right posterior plate diagonally backward and to the right toward the middle of the adjoining plate. The facet for the support of the left posterior arm and the branch of the food-groove leading to the margin of this facet are well preserved; only a short part of the adjoining branch of the food-groove is seen. The upper part of the mass of stereom on the right of the food-groove has broken off beneath the level of the facets supporting the right pairs of arms. In both figures the anal pyramid is located on the right. C, five of the cover-plates of the food-groove enlarged. D, one the thecal plates enlarged so as to show the indications of the presence of pairs of lunar pores presented by the epistereom in unweathered specimens. A, B, enlarged 3 diameters; C, enlarged 13 diameters; D, enlarged 8 diameters. The form and relative location of the thecal plates of this specimen are indicated in text diagram 1.

Fig. 2. Comarocystites punctatus Billings. Specimen belonging to Walter R. Billings; view of right side, magnified 2.4 diameters. Photographed so as to show the anal pyramid, the thecal plates immediately surrounding the anal pyramid, and the diagonal arrangement of the thecal plates on this side of the specimen. Indications of the transverse apical food-groove terminating at the two masses of stereom supporting the pairs of arms are seen along the upper part of the figure.

Figs. 3, 4. Comarocystites punctatus Billings. One of the brachials and one of the pinnulars of the type illustrated on plate III, magnified. 3, three views of a brachial, magnified 3 diameters; A, cross-section with indication of facet for attachment for the pinnule on the right; B, side opposite the facet; C, side showing the facet. 4, three views of a pinnular, magnified 6 diameters; A, cross-section; B, side opposite the cover-plates; C, side showing three cover-plates along one edge.

(*To be continued*)

SEA SQUIRTS.

By Professor E. E. Prince, Commissioner of Fisheries, Ottawa.

No one who has spent a few hours on the sea shore, turning over weed-covered stones, can have failed to notice clusters of leathery objects, styled by the fishermen sea peaches, sea apples, sea potatoes, etc. They are of various shapes, as these names indicate, and differ in colour, some bright pink, others scarlet, or orange, or pure white, or stone colour, and other tints. Some strongly resemble leathery grapes, or coarse plums, or even small leather bottles, while many are semi-transparent, and not unlike green-glass flasks, one or two inches long. They cling by the base to stones and other objects, and frequently hang from the underside of shelving rocks, others are upright and stalked, resembling a brown potato on a long stem (like *Boltenia*), others are jelly-like colonies (such as *Amarousium*), and some occur as long strings of clear glassy creatures, floating as *Salpa* does, near the surface of the sea. On touching them they squirt out two thin jets of water, from an aperture at the top, and another at the side. They have the appearance of motionless vegetables, and are scientifically called Tunicates, or less accurately, Ascidians, but by more philosophical naturalists they have been dignified with the name Urochordates. They merit some notice in these pages for two reasons, viz:—their very special scientific interest, and for a second important reason, that they have formed the subject of some most remarkable original investigations by Dr. A. G. Huntsman, of the University of Toronto, a distinguished worker among our younger Canadian biologists. The high scientific interest possessed by the Tunicates, or Sea Squirts, arises from the fact that they have been looked upon as the ancestral progenitors of the human race (or rather of all vertebrates), and about them Andrew Lang wittily wrote:

"The ancestor remote of Man,
Says Darwin was the Ascidian."

The additions to our knowledge of Canadian Ascidians, due to Dr. Huntsman's labours, are a source of just pride to our scientists. Dr. Huntsman was trained under Professor Ramsay Wright, whose retirement from his Toronto chair zoologists on this continent will never cease to deplore. Laborious and successful work at the three Dominion Government biological stations, during many years, led to Dr. Huntsman's appointment by the Biological Board recently to the responsible position of curator in charge of the marine and fishery investigations at the Biological Station, St. Andrews, New Brunswick. His work now covers a varied field, but it is his Tunicate researches that claim notice here.

In 1908 and 1909 Dr. Huntsman investigated the Ascidians of British Columbia, making a fine collection himself, and having placed in his hands collections made by Professor John Macoun, and by myself and the late Rev. G. W. Taylor, and others. As a result of his studies he was able to publish several papers on these curious creatures, but his most notable memoir: "The Holosomatous Ascidians from the coast of Western Canada," covering over 80 pages of the volume; "Contributions to Canadian Biology, 1908-1911," with 12 splendid photographic plates, and issued by the King's Printer, Ottawa, in 1912, is an extensive and thorough record of his discoveries. It has attracted wide attention, and specialists in various countries, from the United States in the west, to Russia in the east, have welcomed this memoir as an unusually important one. Indeed, Professor W. Redikovzew, a distinguished Russian zoologist, has been so impressed by Dr. Huntsman's results as to adopt these Canadian discoveries and conclusions set forth in the memoir alluded to, and has embodied them in a fine paper, in Russian, recently issued at Petrograd.

Dr. Huntsman's beautiful plates, with precisely 100 figures, are heliotypes of his own exquisite photographs of Ascidians. They are so skilfully done that the most minute structural features are shown with marvellous delicacy and faithfulness. The descriptions in the text are clear, accurate, and models of scientific exposition. Important classificatory features are given in graphic tabular forms, inserted under each species, and summarizing measurements, and other details.

It is impossible here to do more than indicate some of Dr. Huntsman's results. They embrace the following families:—The Perophoridæ; the Family Agnesiidæ, with one species new to science; the Chelysomatidæ, three new species; the Caesiridæ, four new species; the Styelidæ, five new species, including, indeed, a new genus, Chemidocarpa, and one new species *Metandrocarpa Taylori*, appropriately named after the late Rev. Mr. Taylor, who did herculean work as a pioneer in Pacific zoology; and, finally, the Family Tethyidæ. In view of our extended knowledge, due to Dr. Huntsman's researches, the last-named Family has acquired a new significance, and one of the genera, Boltenia, has changed its application. Very interesting facts are to be noted regarding the geographical distribution of these sedentary forms. The two species *B. ovifera*, of the eastern shores, and *B. villosa*, of the Pacific shores, meet in the northern waters of Alaska, and as Dr. Huntsman observes, "perhaps overlap" in Behring Sea. Some species seem to be very local, while others are world-wide in their range. The familiar *Pelonaia corrugata* occurs in both oceans, and in the Arctic as well, and presents in all localities the same features; "they do not seem to differ in any respect," as Dr. Huntsman notes. Alas, they are the homeliest in looks of all the Tunicates! The same ubiquity applies to the greenish transparent *Ciona intestinalis*. *Phallusia ceratodes* appears, on the contrary, to be very local, and is a species first found and named by Dr. Huntsman, and "quite distinct from any yet described." In contrast are forms like *Ascidiopsis paratropa*, a new species described by the author, and very distinct, yet closely related to species from Corean seas, from Northern Europe, and from Puget Sound, which latter is, however, less than a hundred miles south of Departure Bay, where it was first discovered.

But if the colours, the forms, and the distribution of these strange animals present such striking features, their life-history, physiology and anatomy are, to the popular mind, even more extraordinary. Thus, they possess a heart, without valves, and ventral in position, below the base of the endostyle. The heart, in all true invertebrates possessed of that pulsating organ, is dorsal in position, but in man and the Vertebrata it is on the ventral or under side, as in Tunicates. It is enclosed in a pericardium, and pulsates with a progressive vermiform movement, and every few minutes it reverses its action, and drives the blood in the opposite direction. Thus the heart's contractions drive the blood now this way, now that way, a curious characteristic feature of the Sea Squirts, and not probably found in any other group of animals. Can it be that human fickle-heartedness has come down to us from our Ascidian ancestors, with their uncertain cardiac phenomena! The endostyle is interesting, and is a long open canal, glandular and ciliated, with thickened sides, and extending along the ventral face of the cage-like gullet or perforated branchial pharynx. It is active in the digestive functions. The sac-like body has two important openings, one at the top, inhalent, and the other lower down at the side, which is exhalent. A thick coat or tunic loosely encloses the whole animal, whence the name Tunicate. This peculiar leathery tunic shows fibrillæ, and even cells (mesoderm cells which have wandered from the body of the enclosed animal), but it contains, most wonderful of all, a substance, like the cellulose which is peculiar to plants. Bertholet regarded it as a special substance, Tunicin, but recent researches appear to confirm the old and long accepted view that it is really cellulose. Now, cellulose has been regarded as affording one of the distinctions between plants and animals, but this outer coat of the Ascidians is an animal product, though not more essentially a part of the Tunicate's body than the shell of an oyster or clam. A thin epidermis covers the tunic, in which pigmented cells occur, and these migrate into the tunic itself and impart to the animal its colour, which is very brilliant and striking in some Ascidians.

A few words only can be added about the life-history and development of Tunicates. Eggs and sperms are produced by the same individuals, though some are protandric, and do not produce eggs until after the sperms are ripened; but budding also occurs, and reproduction by stolons, a peculiar phenomenon. From the egg issues a larva, very like a tadpole, the enlarged head of which possesses several sticky papillæ for the purpose of adhering to external objects. A strong muscular tail permits it to progress actively through the water. A rod passes down the centre of the tail composed of a row of cells at first, but later by the coalescence of these cells, it appears as a clear hyaline resistent rod, or axis, representing the notochord or primitive backbone of all higher animals. This first indication of a vertebral column is a profoundly interesting feature in Tunicates. Hardly less interesting are the larval organs of vision and hearing, though, like mythical Cyclops, there is only one eye, and the ear or otocyst is unpaired. Some Tunicate larvæ secrete a clear gummy blanket or floating house, and live in it for a time, at the sea's surface. *Oikopleura* does that.

It is unnecessary to describe subsequent changes further than to say that, at a certain stage, the wriggling tadpole becomes rooted by its mouth-end to rocks or other objects, loses its tail, its eye, its ear, and other organs, and becomes changed into a leathery sac-like creature, sightless and motionless, the typical rooted Ascidian, such as those Dr. Huntsman describes. There are three main types among the Tunicates, viz.: the Ascidiaceæ, the Thaliaceæ, and the Larvaceæ, and over one hundred genera. A promising field waits investigation, and Dr. Huntsman's additions to our knowledge proves what a great opportunity for scientific discovery young Canadian workers have who resort to our three Government biological stations each summer. The Tunicates offer a fruitful field for research. Science has revealed unexpected marvels in the study of these lowly-looking Tunicates, but while they are degenerate, as a class, they appear undoubtedly to have formed the starting point whence higher animals have evolved, and have progressed in an ascending scale until Man, the highest Chordate or Vertebrate, developed.

BOOK NOTICES.

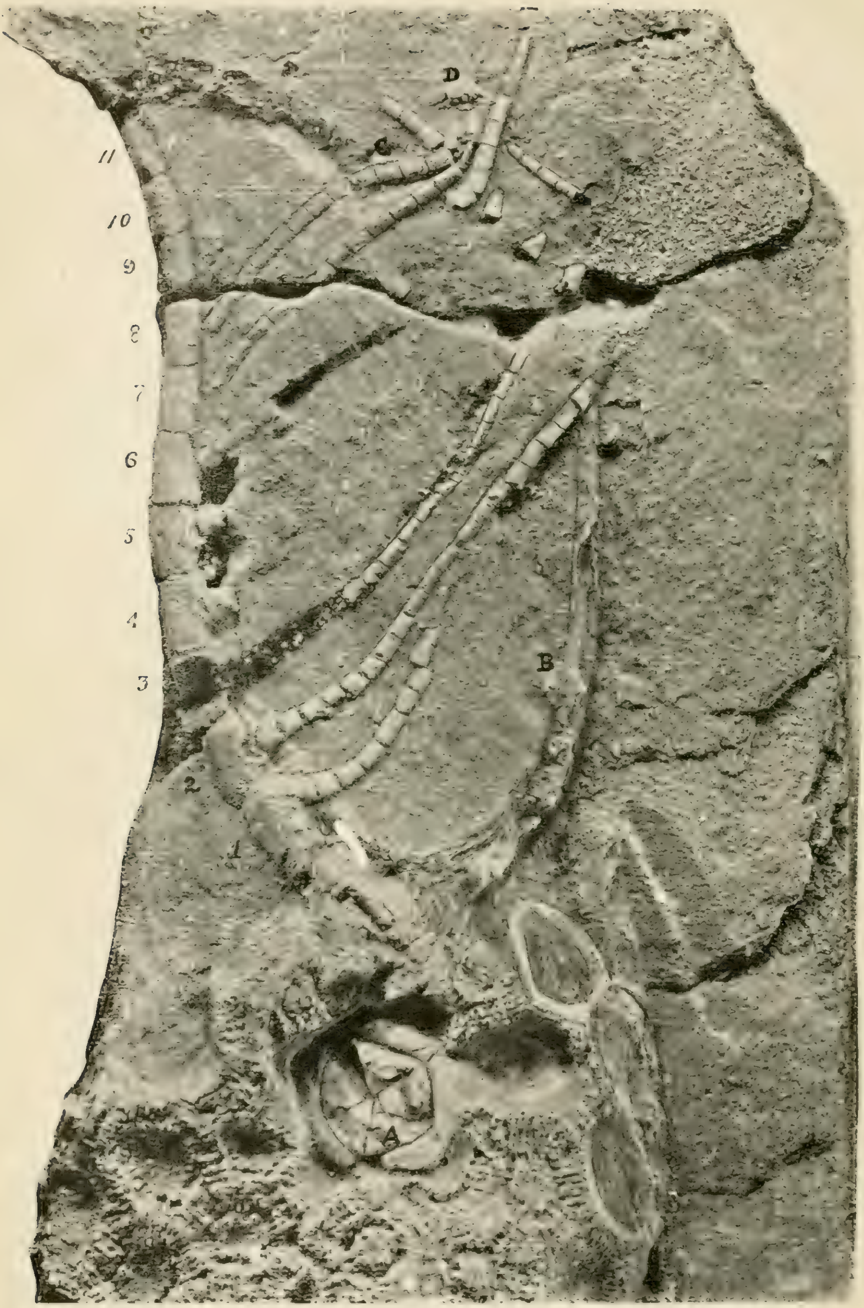
"Edible and Poisonous Mushrooms," by W. A. Murrill, appeared June 26th, 1916. This work consists of a large colored chart and a handbook containing descriptions of the chief edible and poisonous species in North America, together with a discussion of edible and poisonous fungi in general, and methods of preparing and cooking mushrooms. The treatment is brief, requiring only about seventy-five pages, but it covers the ground in a practical and safe way, and will enable the intelligent mushroom-loving public to enjoy many of our native wild species without fear of unpleasant consequences. The writer has erred rather on the side of safety, failing to figure and recommend for food the royal agaric, the blushing amanita, the sheathed amanitopsis, and many other species which are excellent and often eaten.

The chart was prepared under the author's direction by a very careful artist, and is suitable for hanging on the wall in libraries and schools, as well as in botanical museums. Different backgrounds are used for the edible and poisonous species, which are separated and plainly labelled, so that no mistakes can occur. The maximum of safety lies in accurate figures, and descriptions not only of species that may be safely eaten, but also of all the dangerous species that should be avoided.

The price of the handbook and chart is $2.00. Copies may be obtained from the author, whose address is Bronxwood Park, New York City.

Entomological Society Report.

The 46th Annual Report of the Entomological Society of Ontario recently appeared. It is one of the most valuable reports ever issued by the Society, comprising 232 pages, and presents the proceedings of the 52nd annual meeting, held in Ottawa on November 4th and 5th, 1915. Thirty papers are given in full, many of which are illustrated. All students of insect life, not only in Canada, but elsewhere, will undoubtedly welcome the appearance of this splendid report. Most of the articles discuss important crop pests of the farmer and fruit-grower.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COMAROCYSTITES AND CARYOCRINITES.

CYSTIDS WITH PINNULIFEROUS FREE ARMS.

BY A. F. FOERSTE, DAYTON, OHIO.

(Continued from page 79.)

13. *The structure of the thecal plates.*—The exterior surface of the thecal plates of *Comarocystites punctatus* is deeply concave. The interior surface, however, appears more or less stellately convex. The convex appearance is due, in part, to the slopes of the suture planes, converging toward the center of the theca, and, in part, to the thinning of the plates toward the angles of their polygonal outlines. The stellate character is due to grooves separating the different sets of mesostereom plates, described later in this paragraph. These grooves narrow toward the angles, thus increasing the stellate appearance.

In cross-sections which are vertical to the surface of the thecal plates and perpendicular to the middle parts of the sutures between the plates, the inner surface of the plates presents an almost straight outline between the center of one plate and the center of the next, or there is a moderate outward bending of this outline at the suture. However, toward the angles where three plates meet, the inner surface of the plates curves so strongly outward as to produce the appearance of deep triangular pits at these points of junction. Owing to the deep concavity of the exterior surface of the plates, the thickness of these plates varies from five-tenths to six-tenths of a millimeter at the center to nearly two millimeters along the middle of the suture lines. Toward the angles, however, where three plates meet, and where the inner surface of the plates curves strongly outward, so as to approach the outer surface, the thickness of the plates frequently is reduced to about a quarter of a millimeter. Viewed from the interior of the theca, with the plates still connected, the deep triangular pits or depressions between the ends of the stellate rays characterizing the individual plates, form the most striking features.

Beneath the thin non-porous epistereom lies the thick mesostereom. That part of the mesostereom which is in contact with the epistereom forms a practically continuous sheet, penetrated only by pores, and from this sheet the greater part of the mesostereom is suspended in the form of vertical lamellæ. (Plate IV, figs. 3 and 1D.) Viewed along the suture planes, where exposed by the dismembering of the theca, these lamellæ appear thin and narrow toward their junction with the continuous exterior part of the mesostereom, but they thicken toward their inner terminations for a distance of almost a millimeter. These lamellæ do not radiate from the center of the thecal plates, but form groups, all lamellæ belonging to the same group being perpendicular to the same suture line between two adjacent plates. If imaginery lines be drawn from the center to the angles of each plate, then the lamellæ will be found grouped in triangles limited laterally by these imaginary lines. In each triangle the lamellæ will be found perpendicular to the suture line forming the base of the triangle, the triangles of adjacent plates forming rhombs, which, however, give no indication of their presence on the unweathered surface of the plates. The adjacent triangular groups of lamellæ are separated usually by grooves, widening toward the center of the plates and narrowing toward the angles. Both the lamellæ and the inter-lamellar spaces are directly connected across the suture planes.

The epistereom is thin and non-porous. However, if only slightly weathered, it is found to be underlaid by pairs of short lunate pores extending parallel to the epistereom, just beneath the latter, appearing on the weathered upper surface of the mesostereom as short lunate grooves, the concave sides of each pair facing each other. The presence of these pairs of lunate pores often is indicated on the exterior surface of the epistereom by short lunate ridges (Plate II, figs. 1A, 1B, also 1D), which correspond in size, form and position with the pores beneath. Three or four series of these pairs of lunate pores may occur between the centers of the thecal plates and the suture lines, the pairs of different series more or less alternating with each other in position.

Each lunate pore is connected near its distal end with a small circular or oblong pore penetrating the outer more or less continuous sheet of the mesostereom, and leading into the spaces between the vertical lamellæ. Pores of the same pair always connect with different inter-lamellar spaces, being separated by one of the lamellæ. The right hand pore of one pair, however, usually is connected with the same inter-lamellar space as the left hand pore of the nearest adjacent pair, proximally or distally, i.e., either nearer the center of the thecal plate or nearer the suture line. In this manner, three or four pores belonging to different pairs may be connected to the same inter-lamellar space. There is no connection between pores belonging to the same pair.

The pores penetrating the outer continuous sheet of the mesostereom are directed perpendicularly toward the suture lines between the plates, but incline more or less obliquely downward. They apparently widen in a direction parallel to the inter-lamellar spaces in passing through the outer sheet of the mesostereom, since, in strongly weathered specimens showing the inter-lamellar spaces (Plate III), the latter frequently appear interrupted by transverse partitions a short distance below the outer continuous sheet of the mesostereom. At the center of each thecal plate there is a space, at least a millimeter wide, within which no trace of the vertical lamellæ appears.

14. *Sections across the anal pyramid and the transverse apical food-groove.*—A cross-section of the anal pyramid of *Comarocystites* shows that the lower margin of the pyramid plates fits into a groove extending along the lower part of the proximal margin of the bordering thecal plates. The upper part of this proximal margin rises sufficiently to admit of the presence of some substance for opening the anal passage on the relaxation of the muscles holding the anal plates shut from within the thecal cavity.

The mouth, or opening into the interior of the thecal cavity, is scarcely a millimeter in diameter, and is located at the posterior end of the suture between the two anterior peristomial plates (a, a, in the text diagrams). In form this opening varies from nearly circular to more or less elliptical, with the longer diameter parallel to the direction of the transverse apical food-groove. From this mouth the lateral primary rays of the food-groove system diverge in opposite directions in such a manner as to produce a slightly curved transverse continuous groove across the apical end of the theca, with the convex side of the groove directed toward the front. This transverse food-groove, between the bases of the arm pairs, is frequently exposed, but the central mouth opening is rarely seen. Cross-sections perpendicular to the length of the transverse apical food-groove in one specimen indicate that the lower part of the posterior peristomial plates, projects slightly beneath the adjoining part of the anterior peristomial plates, especially toward the lateral extremities of this food-groove. To what extent this feature is present in other specimens is unknown.

15. *The arms of Comarocystites punctatus.*—Each pair of arms is supported by a single nodular stereom protuberance, but each protuberance is supplied with two more or less divergent facets (see facet 1, in fig. 1B on plate II.) for the attachment of the arms. Each end of the transverse apical food-groove, on coming in contact with the adjoining protuberance, bifurcates, each branch of the food-groove, together with its covering-plates, extending to one of the arm bases, and then rising along the adoral side of the first brachial.

Arms are known only in the case of two specimens, one found and figured by E. Billings, the other found and figured by Sir James

Grant. The first presents a clearly defined view of the lower half of the right posterior arm, with its attached pinnules. The second presents a much less clearly defined view also of what appears to be the right anterior arm, with its attached pinnules. Evidently both the brachials and pinnulars of these two arms are arranged in uniserial order. It is assumed that the left pair of arms presented the same characteristics. Only the right posterior arm attached to the Billings type-specimen is here described in detail.

Twelve brachials (Brachials 1 to 11 are numbered in the figure on plate III) are exposed, and each bears a single pinnule on its right side. All of the brachials above the first are flattened slightly from front to rear (Plate II, figs 3A, B, C), the ratio of the lateral diameter to the adoral-aboral diameter being as 10 to 9 (Fig. 3A). The length of each brachial usually equals about three-halves of its lateral diameter. The facets supporting the pinnules are concave (Fig. 3C), their margins being distinctly elevated, especially on their lower sides. The location of these facets is slightly above the middle of each brachial. On that side of the brachial which is opposite the pinnule (Fig. 3B), the brachial tends to be slightly more angular in a direction parallel to the length of the arm. The original length of the complete arm is unknown, but probably it equalled about three-halves of the length of the theca. The rate of tapering of the successive brachials, as far as preserved, is but moderate. Analogy with *Amygdalocystites* and *Canadocystites* suggests that the pinnules of all four arms of *Comarocystites* were attached to the right side of the arms, the aboral side of each arm facing the observer, and the distal end being directed upward.

16. *The pinnules.*—The length of the pinnules probably equalled 30 millimeters, and may have reached 35 millimeters. There is but little variation in the length and width of the pinnulars, about four occupying a length of five millimeters. Except in the case of the first two or three pinnulars, most of the pinnulars are strongly flattened transversely (Plate III; also figs. 4A, B, C, on plate II), the pinnules being placed, for purposes of description, in an approximately vertical position, with the aboral side facing the observer. The ratio of the transverse diameter to the adoral-aboral diameter (Fig. 4A) is about 8 to 5. The lateral edge of the pinnulars (Fig. 4B) tends to be more or less angular in a direction parallel to the length of the pinnule, thus giving the pinnulars a lens-shaped cross-section.

In the Billings type-specimen, here figured, a series of small, flat, quadrangular plates lines one side of two joints of that fragment of the pinnule which is marked D on plate III, and traces of similar small plates are seen at the point C, on one side of the pinnule attached to the eighth brachial. (See also fig. 4C on plate II.) These small quadrangular plates are interpreted as covering-plates. Their number varies from three in a length of one pinnular, to five in a length of two of these pinnulars.

17. *The absence of food-grooves on the brachials.*—In case of the right posterior arm of *Comarocystites,* one of the branches of the transverse apical food-grooves rises for a short distance along the ventral side of the first brachial, but disappears before reaching the top of this brachial. There are reasons for believing that the absence of food-grooves on the arms of *Comarocystites* is secondary and not primitive. The small quadrangular covering-plates along one side of the pinnules, as described above, suggest the former presence of a food-groove. As a matter of fact, no trace of an actual food-groove has been noticed so far on any pinnular, but analogy with *Amygdalocystites* demands that they should be present.

In *Amygdalocystites* the food-groove follows one of the narrower sides of the pinnule, the pinnulars being compressed laterally, and the food-groove faces the mouth. In a similar manner the few covering plates found so far on the pinnulars of *Comarocystites* are on the side facing the mouth, and the sides of these pinnulars are even more compressed than in *Amygdalocystites.* Originally, a food-groove must have followed that side of the pinnule supporting the covering-plates, and a second series of covering-plates must have existed along the same side, but beyond the food-groove. Formerly the food-groove on the pinnulars must have connected with one of the brachials, thus reaching the transverse food-groove along the apical side of the theca, if the analogy between *Comarocystites* and *Amygdalocystites* and *Canadocystis* is as great as here suspected. It should be noted, however, that the facets supporting the pinnules of *Amygdalocystites* are distinctly indented on the side where the branch from the food-groove on the arm passed on the base of the attached pinnule. In *Comarocystites,* however, the facets supporting the pinnules are circular, and show no such indentation. Evidently the absence of a food-groove extends to the lower pinnulars at least.

18. *The column or stem.*—The column or stem is cylindrical, with no evidence of pentamerism either exteriorly or interiorly. The segments or columnals are very thin, alternating in thickness, about 20 occurring in a length of six millimeters in the column attached to that Billings type-specimen which retains the arm. This column has a diameter of four millimeters. The surface of the column is ornamented by minute granules, seven in a width of one millimeter, arranged quincuncially, in diagonally intersecting rows. The lumen equals about one-fourth of the diameter of the column. The flat surfaces of the columnals are striated radially. The only known complete column is attached to the specimen discovered and described by Sir James Grant, and figured by him in the Transactions of the OTTAWA FIELD-NATURALISTS' CLUB, in 1880. In this specimen the

theca is 65 millimeters in height, the length of the column is 108 millimeters, its width near its attachment to the theca is 7 millimeters, at mid-length this width is nearer 5 millimeters, toward the base of the column it increases to 6 millimeters, and then, within a distance of 3 millimeters, the column widens rapidly into a circular attachment disk, about 17 millimeters in diameter. The upper surface of this attachment disk is convex, and the lower surface is sufficiently concave to suggest attachment to a more or less convex object. The outlines of this attachment disk probably were irregularly circular, certain parts extending farther than others from the center. There is no differentiation in size or form between the columnals along the middle third of the stem compared with the columnals toward either end. All are very thin and of approximately the same lateral diameter. During the growth of the stem the columnals probably were added at the top. The stem evidently was sufficiently strong to support the theca in a more or less erect position.

19. *Geological horizon and geographical distribution.—Comarocystites punctatus* Billings is known chiefly from the Trenton, in the vicinity of Ottawa, in Canada. Professor Percy E. Raymond, who has made a special study of the Ottawa area (Guide Book No. 3, International Geological Congress, 1913, p. 151), cites *Comarocystites punctatus* only from the quarry located in the angle between the two railroads, several hundred yards north of Walter's Axe Factory quarry, in Hull, a town on the opposite side of the river from Ottawa, northwestward. Here it occurs in the *Crinoid* zone, associated with *Edrioaster bigsbyi, Cyclocystoides halli, Isotelus latus,* and *Amphilichas cucullus.* The strata in this quarry consist of rather thick-bedded, coarse-grained, gray limestone, separated by black shale partings in which most of the fossils are found. The writer found two specimens of *Comarocystites* on the surface of the highest layer of massive limestone exposed in the Robillard quarry, three miles east of Ottawa, on the south side of the Montreal road. This massive limestone is referred by Raymond to the *Tetradium* zone, and belongs above the *Crinoid* zone. The top of the *Tetradium* zone is exposed also in the quarry immediately behind the axe factory, in Hull. In the overlying *Prasopora* zone Mr. James E. Narraway found several specimens of *Comarocystites.* Several small specimens were found by Mr. Narraway in the lower part of the *Cystid* zone exposures at Nepean Point, within a short distance of the horizon at which *Agelacrinites inconditus* is fairly common. This part of *Cystid* zone is probably not far above the top of the *Prasopora* zone. The well preserved theca illustrated by figure 1 on plate II of the present communication was found by Mr. Narraway, in the quarry at the northeast corner of Bell Street and Carling Avenue, immediately east of the railway leading into the lumber yard east of Dow lake. Here

Agelacrinites chapmani occurs in one of the lower layers of limestone, and the *Comarocystites* was found about five feet above this level. The exposures in the quarry belong to the upper part of the *Cystid* zone. It is evident that the types of *Comarocystites punctatus* were found in the *Cystid* zone, since Billings stated in his original description that the specimens occurred "generally along the water's edge, from the Rideau Falls to the Chaudiere." The remarkable specimen obtained by Sir James Grant from an excavation on St. Patrick street, near Chapel street, in Ottawa, also may have come from the *Cystid* zone, but there are no exposures at present in this area, by means of which the horizon may be established definitely. Evidently *Comarocystites* has a considerable vertical range in the Trenton of the Ottawa area, being unknown so far only from the *Dalmanella* zone, at the base of the Trenton, and from the *Hormotoma* or *Sponge* zone, at the top of the Trenton. In the intermediate zones it evidently occurs at more or less remote intervals, and is a comparatively rare fossil.

Possibly there are two species of *Comarocystites* in the Ottawa area; one of larger size, with more compressed theca, and with nearly smooth thecal plates; the other smaller, less compressed, with minutely granular thecal plates, marked by pairs of distinctly lunate short ridges. The second form is known to occur at the top of the *Tetradium* zone, immediately beneath the *Prasopora* zone, and in the *Cystid* zone. Possibly the smooth form occurs at a different horizon, but the number of well preserved specimens at hand is not sufficient to determine whether the smooth and ornamented forms in reality are distinct or not.

Comarocystites punctatus is cited by Rominger also from the Trenton, in section 17 of township 41, above the big bend in the Escanaba River, north of Little Bay de Noquette, in Michigan.

20. *Literature on Comarocystites punctatus*:—
Comarocystites punctatus Billings:

Billings, Canadian Journal, 2, 1854, p. 270, figs. 1-3.

Figure 1 in this paper corresponds to figure 2 on plate V of Decade III. Figure 2 is an apical view of the same specimen and corresponds to figure 2b in the Decade, but is not identical with the latter; there is no indication of a pair of arms at the upper end of the figure, but only of a single protuberance, and the location of the anal pyramid beneath the pair of arms in the lower part of the figure is shown. Figure 3 corresponds to figure 1 of the Decade.

Geol. Surv. Canada Rep. Progr. for 1853-56, 1857, p. 288.

Geo. Surv. Canada, Dec. 3, 1858, p. 61, pl. 5, figs. 1-1b, 2-2b.

Figure 1 (No. 1391g, in Victoria Memorial Museum) represents the right side of the theca; *o* is the anal pyramid. In figure 1b, the smooth proximal parts of the polygonal plates surrounding the anal pyramid are represented incorrectly as though forming a circle of separate plates surrounding the anal pyramid. In figures 1a and 2a, the non-porous epistereom has been removed by weathering from the marginal parts of the thecal plates. Figure 2 (No. 1391, in Victoria Memorial Museum) presents a view of the anterior side of the theca, with the anal opening on the left upper margin of the figure; the nodular stereom mass supporting the right pair of arms is seen immediately below the number 2, and the angle at the upper right hand margin of the figure indicates the location of the other stereom mass. Figure 2b is a very unsatisfactory representation of the transverse food-groove extending from the central mouth in opposite directions to the base of the stereom mass, where it forks dichotomously at each end.

Grant, Trans. Ottawa Field-Nat. Club, 1, 1880, pl. 1, figs. 1-5.

Figure 1 (No. 333 in Victoria Memorial Museum) probably presents a view of the anterior side of the theca, in addition to a view of the entire length of the column, including its base. Only the lower parts of the arms and pinnules of this specimen are represented in this figure. The remaining figures are re-publications of figures in Decade III, of Billings, figs. 2, 3, 4 and 5 corresponding to figs. 1, 2, 1b and 2b respectively of the Decade

Chapman, Exposition of the Minerals and Geology of Canada, 1864, p. 109.

Haeckel, Amphorideen u. Cystoideen, 1896, p. 70, pl. 1, figs. 4-4c.

Figure 4 is a reproduction of Billing's figure 1 on plate 5 of Decade III, amplified by Haeckel so as to suggest the appearance of a complete arm system and a complete column. The biserial arrangement of the pinnules is incorrect. In figure 4a, the series of small plates surrounding the transverse food-groove is imaginary; the figure evidently is based on figure 2b of the Decade.

Jaeckel, Zeits, d.d. geol. Gesell. 52, 1900, p. 676.

EXPLANATION OF PLATE III.

Comarocystites punctatus Billings. Upper part of type figured by Billings in his monograph on the Cystideae of the Lower Silurian rocks of Canada, in Decade III, of Canadian Organic Remains, in 1858, where it forms figure 1 on plate V. The specimen has been crushed in a direction perpendicular to the anal pyramid. Only the upper part of the right side of the theca is shown in the figure here presented, magnified 3 diameters. A considerable part of the right posterior arm is exposed. The brachials are numbered. The exposed surfaces are interpreted as the dorsal side, most of the brachials showing the facets for the attachment of the pinnules on the right. The pinnules are twisted so as to show both the narrow edges and the flat faces of the pinnulars at different points along the pinnules. The first brachial and several closely appressed pinnules belonging to the right anterior arm occupy the position indicated by B, but can not be distinguished in the figure here presented. Cover-plates may be seen along the right margin of the pinnulars marked D, and along the corresponding margin of several pinnulars marked C in the figure. The position of the anal pyramid and the smooth border of the surrounding thecal plates is indicated at A. The surface of the thecal plates is strongly weathered, except at the center, and indicates clearly the parallel arrangement of all folds and pores of the mesostereom; these are perpendicular to the same edge of the plates; consequently those groups which are perpendicular to different edges form angles with each other along the imaginary lines drawn from the center of the plates to the angles of the latter. The passages of the folds and pores perpendicularly across the sutures from plate to plate, in an apparently continuous manner, also is indicated. For the remainder of the specimen, see the figure presented by Billings. Figure based on photograph supplied by courtesy of the chief photographer of the Geological Survey of Canada. The original specimen is numbered 1391 in the collection of the Survey deposited in the Victoria Memorial Museum, at Ottawa.

NEW SPHÆRIIDÆ.

Dr. Victor Sterki has recently published in the Annals of the Carnegie Museum (Vol. X, Nos. 3 and 4, pp. 429-474), a preliminary catalogue of the Sphæriidæ of North America. The small bivalves of this family are remarkably abundant in the vicinity of Ottawa, and constitute no small part of the food of many fishes and birds. The whole of the material submitted to Dr. Sterki has not yet been thoroughly studied, and what was collected in 1915 and 1916 has not yet been submitted to him. Most of the shells are minute in size, and alike in colour, and for these and other reasons their determination is attended with great difficulty, and, not infrequently, with doubt. The trained eye of Dr. Sterki, and his keen mental apprehension of slight differences, have in my opinion, rendered him capable of accomplishing a task before which other have "backward shrank appalled." While the result of his labors, as published, are modestly stated to be tentative and preliminary, they undoubtedly constitute one of the most valuable contributions made in recent years to the study of our inland mollusca. Several of the species and varieties now described for the first time are from the vicinity of Ottawa, and may be of interest to members of the Field-Naturalists' Club, who wish to spend a little of their leisure riding a delightful if neglected hobby. An hour or two devoted to any elementary work on zoology, dealing—as nearly all do—with the mollusca, will enable any intelligent student to understand Dr. Sterki's descriptions which will then be found to be full, clear and distinctive, though necessarily technical.

The shells themselves occur in every stream around the city. A kitchen bowl-strainer, of coarse mesh—procurable at a cost of a few cents—makes an excellent dredge for the larger species. In the shallows on the right bank of the Rideau Canal, above the by-wash at Hartwell's Locks, hundreds of fine specimens, mainly *Musculium transversum*, may be collected in a few minutes; and this and other species may be found without a dredge by turning over small boulders in the Rideau River, in the rapids near Billings' Bridge. Every depression in which water gathers in our deciduous woods contains the beautiful little *Sphaerium occidentale*, a species capable of living through long periods of drought; and in late summer the northern shores of Duck Island, just at the water's edge, are littered with myriads of small bivalves, mainly a variety of *Sphaerium striatinum*, or, perhaps, a species as yet undescribed. More and more material is required. It is with the hope of stimulating interest, and in order to render accessible to members of the Club descriptions not otherwise readily available that, with Dr. Sterki's permission, the following extracts are reprinted from his catalogue:—

21. MUSCULIUM ROSACEUM FULIGIOSUM var. nov.

Mussel small, rather short, subequipartite, moderately inflated, somewhat "pinched" along the margin; beaks nearly in the middle, narrow, somewhat prominent, calyculate; superior margin angular at the beaks, its anterior and posterior parts straight or nearly so, equally sloping; supero-anterior and posterior slopes, or truncations, well marked, nearly straight, the posterior longer and steeper, nearly at right angle with the longitudinal axis, anterior and posterior ends rounded; inferior margin moderately curved; surface shining and with a silky gloss derived from very narrow, membranous, scaly projections of the periostracum on the fine concentric striæ; shell very thin, glassy transparent, with a marked grayish or smoky hue.

The largest specimen measures: Long. 7; alt. 6; diam. 3.8 mm.

The mussel is striking in appearance, and at first sight seems to be distinct, especially since all specimens are remarkably uniform, but young and adolescent individuals reveal features of other forms of *M. rosaceum*.

Habitat.—Scott Graham Creek, Carleton County, Ontario, collected by Mr. Justice Latchford, 1911 and 1913. Specimens are contained in his collection and in the Carnegie Museum, Nos. 6,945 and 7,431. Justice Latchford writes in November, 1913: "No. 2,925 is quite common. I have visited the creek at all seasons and never found any larger shells than those which I send; I therefore regard them—the larger ones—as full-grown."

[The creek referred to flows eastward through Britannia Highlands, about four miles west of the city limits. Near the Shouldice farm it affords remarkably large and beautiful specimens of *Sphaerium sulcatum.*]

13. SPHÆRIUM TORSUM sp. nov.

Mussel inequipartite, oblique, well inflated, posterior part higher, and much more voluminous than the anterior; dorsoventral axis curved and oblique; beaks strongly inclined forward, large, prominent, rounded, not, or slightly, mamillar; superior margin curved, not, or barely, bounded by angles; scutum and scutellum well marked; anterior and posterior ends rounded, inferior margin moderately curved; surface with fine, slight, irregular or subregular concentric striæ and a few lines of growth, shining; yellow, straw-colored in younger specimens; shell moderately strong; hinge long for the shape and size of the mussel, almost regularly curved, rather slight; cardinal teeth small, the left posterior tooth vestigial in some specimens; laminæ rather slight, at almost a right angle to each other; ligament covered, resilium moderately strong. Soft parts not examined. Long. 11 mm.; alt. 9 mm.; diam. 7 mm. (100 : 83 : 64.)

S. torsum appears to range near *emarginatum* of the same region, but is more oblique, of more rounded outlines, more evenly inflated. The beaks are less elevated, less mamillar, and more inclined forward, and the hinge is much slighter.

Habitat.—Quebec, Ontario, along the Ottawa River, near Hull and Ottawa, collected by Justice Latchford, 1911 and 1912. Types in the collection of Mr. Latchford, and No. 6956 for full-grown, and 7286 for young and adolescent specimens. It occurs also in Wisconsin

Fossil.—Goat Island, Niagara, collected by Miss J. E. Letson, 1900 (No. 2224a).

[Moore's Creek, on the Aylmer Road, north of the road, affords large numbers of this species.]

32. PISIDIUM LATCHFORDI sp. nov.

Mussell small, inequipartite, oblique, nearly oval in lateral aspect, well inflated; beaks somewhat posterior, rather large, prominent, rounded; superior margin curved, supero-anterior slope slightly marked, short, anterior end rounded, well below the longitudinal axis; posterior part short, subtruncate, or rounded; surface slightly glossy, with very fine and slight microscopic striæ, colorless to whitish, shell translucent to opaque; hinge rather long, curved angular, stout, plate rather broad, short; right cardinal tooth well curved, not much projecting, its posterior end not or but little thicker; between it and the somewhat projecting lower edge of the plate there is an elongate-triangular excavation for the left anterior, well defined all around; left anterior set rather well up on the plate, small, posterior oblique, curved; laminæ rather massive, with their surfaces rugose, the anterior and posterior at right angles to each other; cusps of the left ones pointed, with the proximal and distal slopes steep and almost equal, those of the right inner less pointed, outer anterior about one-third the length of the inner, posterior short and small; ligament short, resilium stout.

Measurements.—Long. 2.6; alt. 2.4; diam. 1.9 mm. (100 : 93 : 73).

Habitat.—Ontario, apparently rare. Collected in 1913 by Hon. Justice Latchford, in whose honour the species is named. It occurs in Scott Graham Creek, Graham Bay Creek, and Hare's Spring, all in Carleton County, Ontario. Specimens are in the collection of Justice Latchford and in the Carnegie Museum, Nos. 7,439 and 7,475. Only a rather small number of specimens are at hand, but markedly uniform, and different from all other described species. Their shape, the formation of the hinge, and the stout, short ligament and resilium place them in a group with *P. aequilaterale, fraudulentum,* etc.

["Hare's Spring" is on the Hare farm, Nepean, near the Watson line, about five hundred yards south of the Richmond Road.]

80. PISIDIUM SUBROTUNDUM CANADENSE var. nov.

Mussel larger. Long. 5.5; alt. 4.6; diam. 3.4 mm. More oblique; beaks more posterior; upper margin markedly straight, slightly alate in front of the beaks and bounded by an agle. In shape they somewhat resemble *P. ovum* from Montana, but are less inflated, and the hinges are different. Some specimens in the same lot have the beaks narrower, and are more markedly different from *P. subrotundum.*

Habitat.—Hare's Spring, Carleton County, Ontario, collected in considerable numbers by Justice Latchford. Represented in his collection, and in the Carnegie Museum, No. 7,437. May be distinct.

84. PISIDIUM VEXUM sp. nov.

Mussel small, slightly inequipartite and oblique, rather well inflated; beaks slightly posterior, rather broad, more or less flattened on top, moderately prominent, descending abruptly towards the posterior part; superior margin nearly straight, bounded by angles, posterior margin subtruncate or rounded, passing into the moderately curved inferior without an angle, anterior end rather broadly rounded, supero-anterior slope marked, nearly straight; surface dullish to somewhat shining, with very fine and slight subregular striæ. Shell thin, translucent to transparent, colorless; hinge rather slight, but well formed, moderately long, plate rather narrow; cardinal teeth rather long, the right curved to nearly straight in its middle, its posterior end thicker and grooved to bifid, left anterior more curved (in plane), not much bent upward, posterior long, nearly straight and a little oblique: laminæ; right anterior inner rather long, its cusp nearer the cardinal; outer short; posterior both short; left: both with the cusps rather abrupt, pointed; ligament short, resilium rather stout.

Measurements.—(Specimen from Ontario) Long. 2.5; alt. 2.1; diam. 1.5 mm. (100 : 84 : 60). (Specimen from Massachusetts) Long. 3; alt. 2.5; diam. 2.1 mm. (100 : 83 : 70).

P. vexum is somewhat like *P. inornatum* in size and shape, but more inflated; the shell and hinge are slighter, and the depressed beaks distinguish it.

Habitat.—Lake Gorman, Renfrew County, Ontario, collected by Justice Latchford, August 29, 1913. Types are in Justice Latchford's collection and in the Carnegie Museum, No. 7455. One specimen, somewhat larger, was collected in Hounds Ditch, Duxbury, Massachusetts, by Mr. William F. Clapp in 1913.

F. R. L.

THE SHARP-SHINNED HAWK.

By W. J. Brown, Westmount, Que.

Acquaintanceship with the Sharp-shinned Hawk (*Accipiter velox*) occurred twelve years ago, in April, in second growth woods. Here we discovered a specimen, under a cedar tree. devouring a small bird. A friend in parting the branches was rather surprised and startled. Sudden impulse, and visions of a Woodcock's nest, prompted further investigation, but the bird was equally alarmed and left the brush spasmodically. Previous to this, and for some time afterwords. I had entertained confused and mixed ideas as to the status and habits of this species. On May 24, 1908, I noticed a male flying in a jerky fashion through a small area of tamarack woods. At that time it did not occur to me to look for the nest, but the following year I investigated this locality with a friend and we found the nest, with five eggs, in a small tamarack. After watching the actions of the female about the nest I decided at once to learn more about these interesting birds. During the next two weeks I came in contact with two more nests, one in a black spruce and the other in a balsam, all three sets, of five eggs each, varying greatly in size and coloration.

At this period of my investigations I looked upon the Sharp-shinned Hawk as rare in the Province of Quebec. Subsequent research, however, has developed the fact that the bird is one of our most abundant raptores and is much more common that was formerly supposed. Any zealous ornithologist could probably locate two dozen nests in a season, but it is by no means an easy task to cultivate the bird's acquaintance at any time. Shyness is one of the hawk's peculiarities, to say nothing of it's retiring habits, especially in the nesting season. The bird is seldom seen during the period of incubation, except when the nest is in danger. If the male bird is present at this time the flicker-like alarm notes are a sure indication that a nest is close by. Experience (I use this term with calm deliberation) has driven me to the conclusion that the male bird is seldom at home while the female is incubating, but is off on some foraging expedition,—in many instances miles from the nest tree. Having become quite familiar with the breeding haunts of this species and meeting casually with the male in the open country, I have been able to form some estimate of the erratic movements of the smaller parent in the nesting season. Looking for sharp-shinned hawks' nests is tedious work, especially in black spruce bogs of any size, but this is the only satisfactory method of meeting the birds.

The early stragglers appear during the first week in April, but migration depends largely on the season. Some pairs start domestic duties early, as nests have been built by the end of April and contained full sets by May 8. The young have been hatched in the first days of June, but these, of course, are exceptional records. The eggs are usually laid by May 24, and the young are out of the shell about three weeks later. The number of eggs laid is three to six, usually four or five. They are richly marked, and there is an endless variety in a large series of sets.

Unfortunately the sharp-shinned hawk makes heavy raids on our song birds, the white-throated sparrow, chickadee and the warblers being the principal sufferers. I notice that the bird selects a mossy stump or squirrel's nest as a perch for plucking it's victims. Again and again I have stumbled across masses of bird feathers adhering to moss on the ground and on stumps in evergreen woods. Occasionally the hawk loses a feather or two in it's wild flight. These are all tell-tale signs that a pair of these destructive birds are tenants in the wood, and a thorough search always reveals the nest. Where a family has been raised the woods are almost stripped bare of song birds. The majority of nests have been found in black spruce trees, a few in balsam and an occasional one in hemlock, cedar and pine. The height varies from ten to sixty feet from the ground against the base on horizontal branches. The nest does not resemble the bulky structure of the crow as some authorities aver, but is easily distinguishable from the latter by the shallow platform of interlaced spruce twigs. A large number of nests have been built over old foundations, but as a general rule the bird constructs a new nest each season. The usual nest of this hawk is a frail affair of twigs and is sometimes lined with flakes of bark. The tree chosen is on the outskirts of the woods, or at the edge of any clearing or opening in the middle of the woods. A favorite location of the nest is in a thick clump of spruce near a clearing. Any large area of black spruce usually contains a pair of sharp-shins. The bird is generally a close sitter and only a well aimed stick or stub will dislodge her.

There is a certain amount of individuality in this species. Some birds are very quiet after being flushed off the nest, the alarm notes even being absent, while others are very lively and noisy and will return immediately to attack. One pair would not permit packing of the eggs under the nest, but would dart to the ground and almost fly in my face. Some pairs return to the same woods year after year even after bing disturbed. Others may raise their young in a woods, but it does not necessarily follow that the birds will occupy the same locality the next season. Should the first set be taken, the birds have been known to lay a second one in the same nest, or depart a short distance away and start operations afresh, but this is not the rule; the pair generally leave the woods.

The sharp-shinned hawk has two distinct alarm notes when the nest is approached, the usual cackling call in the earlier stages of the nesting season and a series of squealing notes, not unlike those of the grouse, after the young are hatched, alternating from one call to the other when the young are well grown.

En passant, it has occurred to me to point out the characteristics of a pair of hawks which I have kept under observation for a few years.

In the fall of 1912, while exploring some mixed small growth of timber encroaching on a spruce bog, I noticed seven or eight nests of the sharp-shinned hawk placed at low elevations, ten to fifteen feet in height, in black spruce saplings. These were all within a radius of fifty yards and apparently the work of one pair of birds.

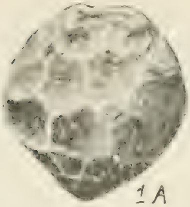
On May 24, 1913, I visited this wood again and rapped all spruces containing these small nests . There were no signs of occupancy about the nests and it was quite apparent that no bird was on any of them. No hawk was seen in the neighborhood, nor was one heard, so the trees were not climbed. Four weeks later, on June 22, I passed through this group of nests and was amazed to see a sharp-shinned hawk leaving one of the identical nests I had previously pounded. In a minute I was gazing at five young sharp-shins in white down, probably only a few days old. The female flew in wide circles around the nest, but was peaceful and silent. On my first visit the bird had, no doubt, left the nest on my approach.

On May 29, 1914, Mr. L. M. Terrill and I purposely set out to gather additional information as to this secretive pair of hawks. On the way we decided not to leave anything to hazard, but to climb to all the nests and examine them carefully. The wood was quiet and no birds were in sight. My friend started to ascend one nest and pointed out another a few yards away. The nest looked old and shabby and I held out little hope, but it's easy accessibility prompted inspection. When on a level with the nest I was surprised to see a set of five eggs. My friend evidently noted my amazement, but all he said was: "Come down and let me have a look at them." About half an hour later we were returning through the same bush and were successful in catching the female slipping quietly off the empty nest. She was very shy and disappeared, and had evidently left the nest when we first entered the woods. The male was not seen. This bird is an early breeder, as the eggs were about ten days incubated.

On May 22, 1915, I moved cautiously through this woods, as I desired to observe this hawk on the nest. I noted the down of the hawk clinging to the branches of trees and knew that the pair were again in their old haunts. Twenty yards away I saw a new nest, the rim of which was covered with down and feathers. Looking more closely through the thick shrubbery I saw the hawk gliding furtively off the nest. She disappeared amongst the dense growth without making a sound. This nest was similar to the others, both as to height and construction, and the five eggs were marked like the first set. I remained in the locality for some time, but neither the male nor female returned.

On May 25, 1916, I learned that the pair had changed their quarters, but I decided to look for them in some familiar spruce woods a mile off. In four hours I discovered a small nest about thirty-five feet up in a black spruce at the extreme edge of the woods near a path. After throwing several sticks into the tree a sharp-shinned hawk bolted off and disappeared immediately into the woods and did not return while I was around. The male, as usual, was conspicuous by being absent. I had located the same pair once more, as the eggs are very much like those taken in the other woods and the actions of the bird were the same. The only departure was the size of the tree and the height of the nest.

It is strange, and at the same time interesting, that the male has not been seen, and that the female has shown persistent lack in vocal effort in the nesting season.



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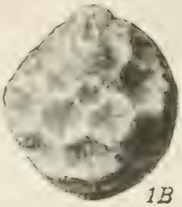

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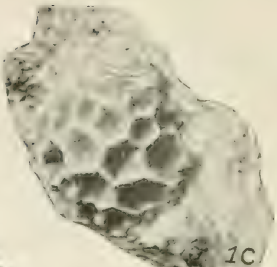

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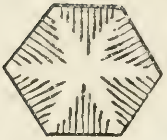

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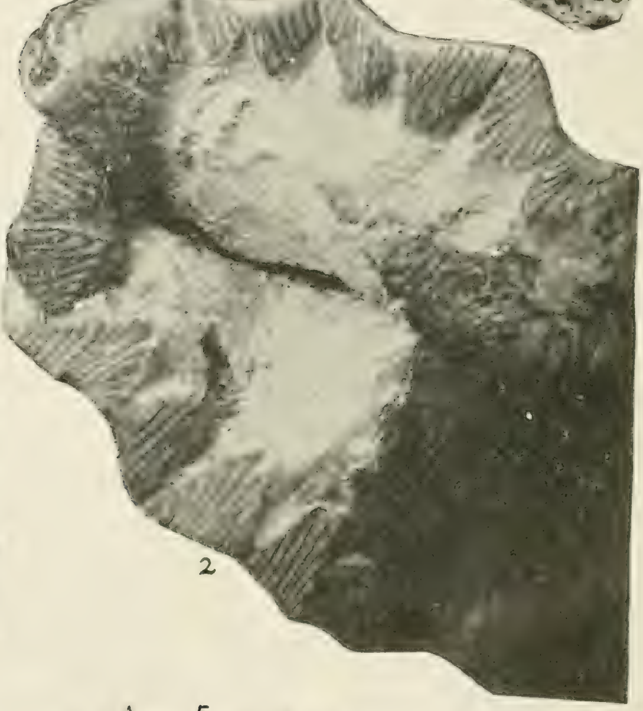

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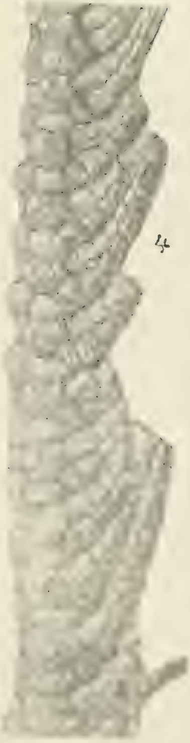

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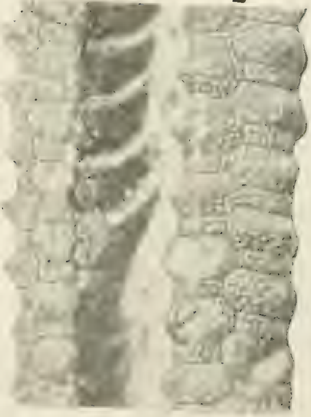
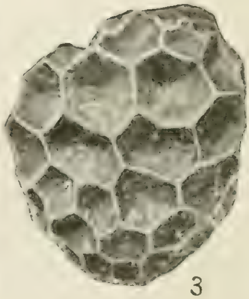


A B



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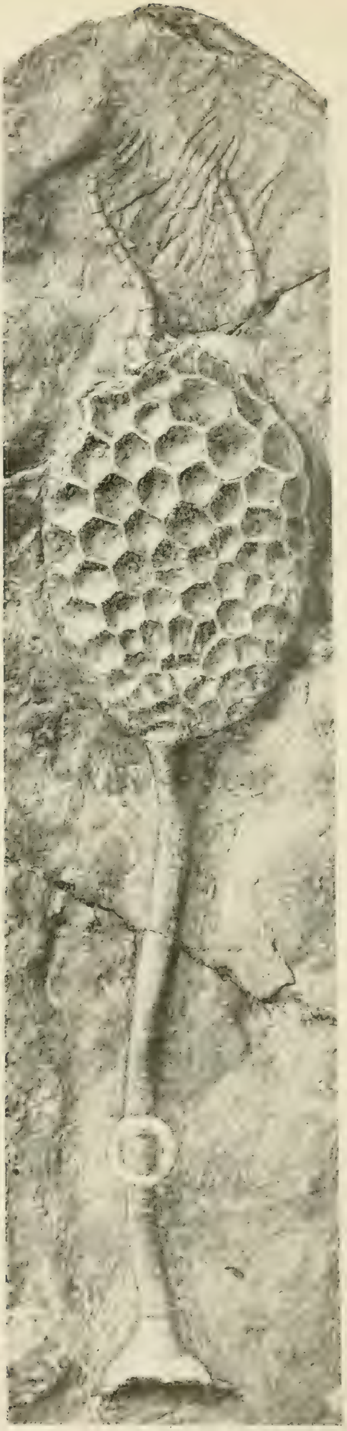

THE OTTAWA NATURALIST

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COMAROCYSTITES AND CARYOCRINITES.

Cystids with Pinnuliferous Free Arms.

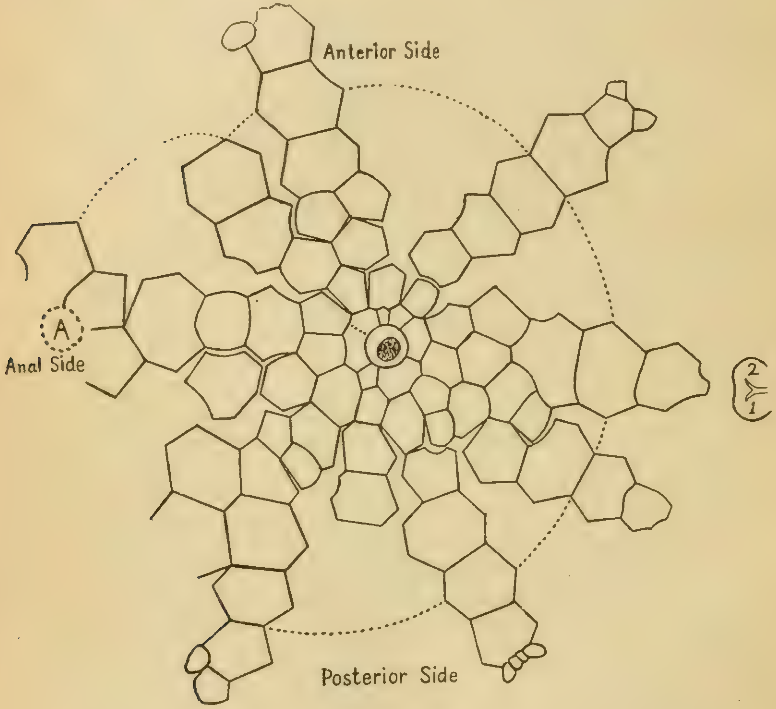
By A. F. Foerste, Dayton, Ohio.

(Continued from page 93.)

Detailed Description of Comarocystites shumardi, Meek and Worthen.

21. *Comarocystites shumardi,* (Figures 1A, B, C, on plate IV) differs from *Comarocystites punctatus* chiefly in the more deeply and more angularly concave thecal plates. These features are well shown by the type specimen illustrated by figures 1A, and 1B on plate I in volume III of the Geological Survey of Illinois. In plates eight to ten millimeters in width the depth of the concavity usually is about three millimeters, in one case equalling four millimeters. From the center of the concavity the inversely pyramidal flattened walls of the concavity slope upward and outward; along lines leading from the center to the angles of these concavities, the flattened walls are separated by more or less distinct narrow grooves, giving the exterior surface of each thecal plate a stellately indented appearance (Fig. 1C). The number of thecal plates in the type specimen probably was somewhere between 65 and 70. The general shape of the theca is shorter and more globose-obovate than in *Comarocystites punctatus.* The line of demarcation between the basal plates is indistinctly defined, but these plates probably numbered more than three.

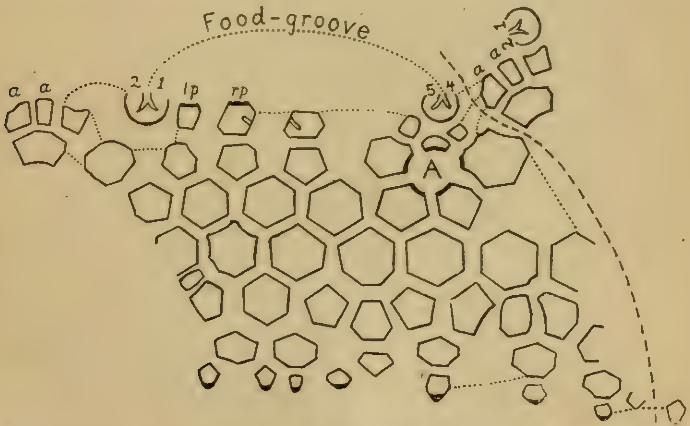
In his original description of *Comarocystites punctatus* (Canadian Journal, 2, 1854, p. 268) Billings stated that "upon the upper joint of the column stand three low but broad pentagonal plates, with serrated edges above. These form a narrow circular pelvis, and are so closely united at their sides that it is difficult to detect the lines of division between them." It probably was the attempt to make their type specimen agree with the description of *Comarocystites punctatus* given by Billings which lead Meek and Worthen to diagram *Comarocystites shumardi* as having three basal plates. (Geol. Surv. Illinois, 3, p. 292). At the time this diagram was prepared a part of the plates of the type specimen of the latter species still were covered by the matrix. Recently the writer removed this matrix and a new diagram has been prepared (Text diagram, No. 4).



Text figure No. 4. Diagram of the thecal plates of the type specimen of Comarocystites shumardi, replacing the diagram published by Meek and Worthen in the report of the Geological Survey of Illinois, volume III, page 292. In order to compare this diagram with that in the Illinois report, the page should be turned so that the part marked anal side forms the bottom of the figure. Additional plates have been exposed recently by removing the matrix. The position of the nodular stereom protuberance supporting the left pair of arms is indicated at 1, 2. The approximate location of the anal pyramid is indicated by A. The apical part of the theca surrounding the right pair of arms, as far down as the plates bordering on the lower side of the anal opening, is missing. The diagram is not intended to suggest any radiate structure in the arrangement of the thecal plates. It is intended, however, to suggest the presence of more than three plates in the basal series, although the evidence in the particular specimen here diagrammed is obscure.

The height of the type specimen equals 39 millimeters, the lateral diameter is 34 millimeters, and the diameter from front to rear is 30 millimeters. The top of the column at its junction with the theca was 6 millimeters in diameter. The left half of the apical transverse food-groove, with its bifurcation on the proximal side of the stereom mass supporting the left pair of arms is distinctly shown, but the right half and all adjacent parts, including the anal area, are missing. Both the apical area, as far as preserved, and the basal series of thecal plates appear compressed in a vertical direction, and there is no reason, judging from other specimens, for believing that the horizontal position of these basal plates is a specific characteristic.

Most of the specimens of *Comarocystites shumardi* so far seen exceed 25 millimeters only slightly in length. In thecal plates 6 millimeters in width, the depth of the concavity may equal 1.7 millimeters. At the bottom of the concavity there frequently is found a circular flattened or slightly convex area, about three-fourths of a millimeter in diameter.



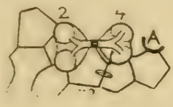
Text figure No. 5. Diagram of the thecal plates of the specimen represented by figures 1A, 1B, on plate IV. The plates on the right side of the vertical sinuous dotted line on the right side of the diagram duplicate some of the plates at the extreme left of the diagram. The anterior peristomial plates are lettered a, a; the right and left posterior peristomial plates are lettered rp and lp respectively. From plate rp the linear hydropore extends diagonally downward and toward the right toward the middle of the next plate. The relative position of the four arms is indicated by the numbers 2, 1, 5, 4. The location of the anus is indicated by the letter A. The basal plates in actual contact with the top of the column, seven in number, are heavily margined at the bottom. Several of the thecal plates on the left side of the specimen are missing.

In the specimen in the Chicago University Museum, illustrated by figures 1A and 1B on plate IV, the area surrounding the anus is distinctly flattened, the area facing diagonally upward, thus producing a strongly angular outline a short distance above mid-height on the right side of the the theca. The arrangement of the thecal plates on this specimen is indicated by diagram No. 5. A part of the thecal plates are missing, the specimen being imperfect, but all of the basal plates are preserved, and, of these, seven appear to be in direct contact with the top of the column. These are indicated in the diagram by the heavy basal margin.

In most other respects, than those cited above, *Comarocystites shumardi* closely resembles *Comarocystites punctatus*. The transverse apical food-groove (Figures 1 A, B, C, and diagram No. 6) branches at each end dichotomously, along the adoral side of the nodular stereom protuberance which supports the right or left pair of arms. Only the facets for the attachment of these arms are preserved, the arms themselves not being retained in any specimen at hand.

The mouth or entrance into the theca consists of a small opening located at mid-length along the transverse apical food-groove, at the proximal end of the suture between plates *a*, *a*, in the diagram. The food-groove is covered by a double series of covering-plates. Two peristomial plates typically are in contact with the posterior margin of the transverse apical food groove, and of these the right peristomial plate is distinctly the larger (Diagram No. 5). From the center of the latter, the linear hydropore ridge (Figure 1C on plate IV, also diagrams 5 and 6) extends diagonally downward and toward the right, toward the center of the plate adjoining it on that side. One specimen shows a minute pore immediately beyond the upper left hand end of the hydropore ridge. There is no evidence of this being a constant feature.

The anal pyramid is not preserved in any specimen at hand, but the circular opening into which this pyramid fitted (Figure 1B on plate IV) is preserved in several specimens, and this shows a diameter of 3 millimeters in a specimen 25 millimeters in height. This circular opening is surrounded by five thecal plates occupying the same position as in *Comarocystites punctatus*.



Text figure No. 6. Diagram of a few of the thecal plates at the apical end of the specimen represented by figure 1C on plate IV; the numbering and lettering as in text figure No. 4. The transverse apical food groove, branching at each end, where the facets of the two pairs of arms are located, the location of the mouth, the anus, and the linear hydropore also are indicated. Special attention is called to the monopolizing of the space posterior to the transverse food-groove by the plate marked rp. In other specimens there is room for smaller plates on the left.

In one specimen (Diagram No. 6) showing the transverse apical food-groove very well, the posterior margin of this food-groove appears occupied exclusively by the plate marked *rp* in the diagram. The stereom protuberances, supporting the arm pairs, appear to rest upon the margins of the adjacent thecal plates. These stereom protuberances appear to be deposits made by the bases of the arms at the ends of the transverse apical food-groove, and not to be a part of the thecal plate system. The peristomial plates, on the contrary, are ordinary thecal plates. Judging from the presence of small plates along the margin of the stereom protuberances in some specimens, and their absence in others, these small plates may be additions during the later stages of growth of the individual.

In *Comarocystites punctatus* the number of thecal plates in a vertical series often numbers 9 or 10; in *Comarocystites shumardi* this number usually is only 6 or 7. The theca grows in size chiefly by growth at the margin of the individual thecal plates. It is quite evident from the absence of small intercalated plates in some of the specimens at least that the enlargement in growth does not depend upon the introduction of intercalated plates within the general body of the theca, although it is not impossible that additional plates, during earlier stages of growth, may be added at the base. The evidence in favor of such a suggestion is not very clear and consists chiefly in the presence, at the base, of plates of small size inserted between those of larger size.

22. *The so-called variety obconicus.*—Meek and Worthen probably were in error in attempting to distinguish a variety *obconicus*, as distinct from *Comarocystites shumardi.* Close examination of the type specimen (Figure 2a, on plate 1, Geol. Surv. Illinois, vol. III) fails to show any distinguishing features excepting that presented by the more attenuate base. As a matter of fact, however, there is no evidence that this attenuate base is anything more than an individual characteristic. The second specimen figured by Meek and Worthen under the variety name *obconicus* (Figure 2b, on plate 1, of the Illinois report cited above) does not differ in any respect from ordinary specimens of *Comarocystites shumardi,* and certainly does not possess an obconical base. The first specimen presents clear evidence of the division of the mesostereom into vertical plates, shorter toward the angles of the plates, and separated by very narrow interspaces. The column has a width of 2.8 millimeters, and 17 columnals of about equal size occur in a length of 5 millimeters. The surface of the column is minutely granulate, as in *Comarocystites punctatus.* The second specimen does not differ in any respect from small specimens of *Comarocystites shumardi.* Only the left half of the theca is exposed but this half includes all, from the base to the stereom protuberance supporting the left pair of arms. Even the forking of the left end of

the transverse apical food-groove, on the adoral side of the protuberance, and traces of the facets for the attachment of the arms are preserved. The presence of vertical plates belonging to the mesostereom is seen along the strongly weathered sutures between the plates. Several of the plates present very clear evidence of the arrangement of the pores, through the continuous exterior surface of the mesostereom, in pairs, and directly beneath the epistereom these pores evidently are elongated in a direction parallel to the narrow spaces between the mesostereom plates beneath.

23. *The structure of the thecal plates.*—A fuller knowledge of the plate structure of *Comarocystites shumardi* is presented by the specimens belonging to the Walker Museum, at Chicago University, and by the specimens belonging to the Illinois State Museum of Natural History (Plate IV, figure 3). The structure evidently is identical with that of *Comarocystites punctatus.* There is the same grouping of pores traversing the mesostereom. The thin epistereom is non-porous, but when weathered away the outer terminations of the pores traversing the mesostereom are seen to be arranged in more or less alternating pairs. Directly beneath the epistereom, each of these pores is connected with a semi-lunate pore, parallel to the outer surface of the plate, the concave sides of each of the semi-lunate pores. belonging to the same pair, facing each other. As in *Comarocystites punctatus,* some specimens show no indication of the presence of these pairs of semi-lunate pores on their exterior surfaces; in others, their presence is indicated by low, short, semi-lunate ridges. The mesostereom consists chiefly of more or less vertical plates, from 6 to 9 in a width of 3 millimeters, intercepted by much narrower spaces apparently connected directly with the interior of the theca without the intervention of a hypostereom. Directly beneath the epistereom, however, the mesostereom forms a continuous sheet penetrated only by the pores connecting the narrow spaces between the vertical mesostereom plates with the semi-lunate pores immediately beneath the epistereom. The thecal plates appear to have grown from the margin outward, so that the pores originating at the sutures later were located in the more central parts of the plates.

24. *Horizon and Distribution of Comarocystites shumardi.*—From the preceding statements it is evident that *Comarocystites shumardi* is a typical representative of the genus *Comarocystites.* The so-called variety *obconicus* is founded, it is believed, upon individual characteristics, and the name should not be retained, even as the name of a variety.

Both *Comarocystites shumardi* and its so-called variety *obconicus* were described from the Kimmswick limestone, at Cape Girardeau, Missouri. By Ulrich, this Kimmswick limestone is placed at the top of the Black river group, beneath the Curdsville horizon at the base of the Trenton, while Bassler cites *Comarocystites punctatus* from the Curdsville at Ottawa, in Ontario, Canada. From this it is evident that Bassler correlates at least the lower Trenton horizons at Ottawa with the Curdsville of central Kentucky. The two horizons at which *Comarocystites* occurs, even if referred to different groups, evidently are not far removed from each other.

25. *Literature on Comarocystites shumardi and obconicus.*

Comarocystites shumardi, Meek and Worthen.

Meek and Worthen, Proc. Acad. Nat. Sci., Philadelphia, 1865, p. 143. Geol. Surv. Illinois, 3, 1868, p. 292, fig.; pl. 1, figs. 1a, b.

The diagram on page 292 is so drawn as to suggest the presence of only three basal plates; in the preparation of this diagram the authors probably were influenced by the original description of *Comarocystites punctatus* (Canadian Journal, 2, 1854, p. 268) in which Billings states that "upon the upper joint of the column stand three low but broad pentagonal plates, with serrated edges above." As a matter of fact, however, these serrated edges suggest the presence of more than three basal plates, although the sutures separating these plates are not clearly defined in the type specimen diagrammed. A line drawn vertically through the center of the diagram would be parallel to the transverse apical food-groove of the specimen, the plates on the left side of the theca being indicated at the top of the diagram, and those on the anal side, at the bottom of the diagram. At the time the diagram was prepared, the upper part of the left side of the theca was concealed by the matrix. Traces of the transverse apical food-groove, bifurcating at the end, were present on the left side of the top of the theca, but were not recognized by the authors. The specimen has been cleaned by the present writer and redrawn for this paper. (Text diagram No. 6). Figure 1a on plate 1 is oriented exactly opposite to the diagram, the anal side facing the top of the figure and the left side facing the bottom. Figure 1b presents the right or anal side of the specimen; the parts immediately surrounding the anal pyramid and all of the upper left hand part of the theca is missing, the extreme top of the figure representing the broken edges of that part of the theca which is beyond the break.

Keyes, Missouri Geol. Surv., 4, 1894, p. 132, pl. 18, fig. 2, Figure 2 presents the basal view of the theca, copied from the Illinois report.

Jaekel, Zeitsch, d. deutsch. geol. Gesellsch., 52, 1900, p. 676.

Comarocystites obconicus, Meek and Worthen.

Meek and Worthen, Proc. Acad. Nat. Sci., Philadelphia, 1865, p. 144. Geol. Surv., Illinois, 3, 1868, p. 294, pl. 1, figs. 2a, b.

The total length of the theca of the specimen represented by figure 2a probably did not exceed 20 millimeters. The appearance of the figure suggests that the plates on the left side of the theca were of enormous thickness, compared with their width. This appearance is due, however, to the growth of calcite in the interior of the theca, the actual thickness of the plates thus represented varying from about 1.5 millimeters, towards the bottom, to almost 2 millimeters at the top of the theca. Figure 2b represents the left side of another specimen with the stereom protuberance, formerly supporting the left pair of arms, at the top.

Keyes, Missouri Geol. Surv., 1, 1894, p. 132, pl. 18, fig. 1. Figure 1 is a republication of figure 2a of the Illinois report.

26. *The zoological position of Comarocystites.*—In 1896, Haeckel separated from the remaining *Cystidea* those forms in which no radial branching of the food-groove system, either trimerous or pseudo-pentamerous, can be detected spreading over the upper surface of the theca. These forms he distinguished as a co-ordinate group under the name *Amphoridea*. Among the *Amphoridea* were placed not only the asymmetric and bisymmetric forms but also those in which the arms branch off radially from the top of the theca, without, however, being attached dorsally, for at least a part of their length, to the upper surface of the theca. To these *Amphoridea* with radially arranged arms he applied the term *Palaeocystida*, and evidently regarded them as ancestral to the *true Cystidea*, especially to the *Glyptocystidae*. Among these *Palaeocystida*, he placed the genus *Comarocystites*.

Bather (Echinoderma, 1900) retained the group *Amphoridea*, but as one of the subdivision of the *Cystidea*, characterized by the absence of radial symmetry in both food-grooves and thecal plates. *Comarocystites*, however, is referred by him to the *Rhombifera*. In the *Rhombifera*, as defined by Bather, radial symmetry affects the food-grooves, and the stereom and stroma are arranged in folds and strands at right angles to the sutures between the thecal plates. In order to bring *Comarocystites* in line with pseudo-pentamerous *Rhombifera,* the former presence of an anterior ray of the food-groove system is imagined.

Jaekel, in 1900, separated from the *Cystidea,* under the name *Carpoidea,* a considerable number of the genera included by Haeckel in his *Amphoridea,* adding also the genera *Malocystites, Canadocystites,* and *Amygdalocystites,* included by Haeckel under his *Cystidea,* in the restricted sense. The chief characteristics of the *Carpoidea* were supposed to be: a loose relation of the ambulacral organs to the theca, leaving only slight traces on the latter; theca never pentamerous, often distorted, usually compressed dorso-ventrally, more or less symmetrical toward the right and left; ambulacra extending into two radii; the brachials bearing the ambulacral grooves uniserial as far as known; base tetramerous or trimerous Those *Carpoidea* possessing biserial columnals Jaekel placed in the subdivision *Heterostelea,* and those possessing a single series of ring-shaped columnals he placed in the subdivision *Eustelea.* The *Eustelea* included *Malocystites, Canadocystitis, Amygdalocystites,* and *Comarocystites.*

It must be acknowledged that the four genera here listed form a very coherent group in which trimerism or pseudo-pentamerism seems never to have prevailed. Under Bather's term, *Malocystidae,* this group has been placed among the *Amphoridea* in the more recent editions of Zittel. The relationship between *Canadocystis, Amygdalocystis,* and *Comarocystites* appears especially close. All of these forms are bisymmetric with the main apical food-groove extending laterally from the mouth, the anal pyramid being on the right side of the theca. Both the brachials and pinnulars are arranged in uniserial order. When the arms are oriented so that the ventral side faces away from the observer and the distal side of the arm points upward, then, in all three genera, the pinnules are seen to form a single row on the right side of the arms. In *Comarocystites* the arms are free. In *Amygdalocystites* and *Canadocystis* the arms are twisted in contrasolar direction and are attached by their left sides to the theca, leaving the right side free for the pinnules.

In the structure of their thecal plates, however, all three genera differ greatly. In *Comarocystites,* the vertical plates of the mesostereom, as exposed on the inner side of the theca, suggest strongly the plates characterizing the pectinirhombs of the *Rhombifera,* although the spaces between these plates do not open at the top in slit-like pores, as in true pectinirhombs. In *Amygdalocystites,* the inner surface of the thecal plates is marked by radial ridges, which in some specimens are sufficiently defined to be called short plates. One radial ridge always extends to each of the angles of the plate, and in some specimens another ridge extends to the middle point of each side. In some specimens pores exist along the sutures between the plates, either a single pore at the middle of each side, or two pores along each side, close to the radial ridges extending to the angles of the plate. Half of each pore occurs on half of each of the adjoining plates. It has not been proved, however, that these pores are open in unweathered specimens. They may be covered by the epistereom, as in the case of the pores of *Comarocystites*. In *Canadocystites*, neither pores nor vertical mesostereom lamellae are present. This difference in plate structure in the three genera is remarkable in view of the close relationship suggested by the structure of the food-groove system. Owing to the entire absence of true pectinirhombs, notwithstanding the suggestive structure of the thecal plates of *Comarocystites*, the separation of these three genera from the *Rhombifera* seems desirable. Regarding *Malocystites*, which appears related to *Canadocystis*, too little is known at present. The recumbent food-grooves extend over the upper surface of quadrangular plates arranged in uniserial order, but it is not known whether the pinnules were attached in a single row, and whether the pinnulars were arranged in uniserial order or not.

V.—ADDENDA.

27. *Notes on Caryocrinites ornatus* Say.—In *Caryocrinites ornatus* both the brachials and pinnulars are biserial in arrangement (Plate IV, figs. 4, 5). This was recognized by Hall (Pal. New York, 2, 1852, p. 219, pl. 49, figs. 1 i, k, m), although he did not get a clear idea of the structure of the pinnules from his specimens. Much better material is present in the collections of Frank Springer, in the U.S. National Museum, at Washington, and this material has been placed freely at the disposal of the writer. Compared with the length of the arms, the pinnules are very short. In a specimen, with a theca 30 millimeters in height, the pinnules attached to an arm 55 millimeters in length were 4 millimeters long. In another specimen, with a theca 12 millimeters in height, and with arms from 36 to 40 millimeters in length, the pinnules were only 3.5 millimeters long (Plate IV, fig. 4). In this specimen, each of the two series of pinnulars rests upon a separate brachial, the lower brachial of each pair being shorter. In other specimens, however, the shorter brachials occasionally are reduced to mere transversely elongated vestiges remaining between the horizontal sutures separating the larger brachials, and in those cases the two series of pinnulars rest practically against the same brachial.

Since typical crinoidal pinnules should present only a single row of pinnulars, it might be emphasized that these so-called pinnules of *Caryocrinites* are not homologous to the pinnules of crinoids, but to the brachioles of cystids. These brachioles, among the *Rhombifera* and *Diploporita*, are uniformly biserial, the individual ossicles alternating in position across the width of the brachiole. As a matter of fact, it is possible to diagram these brachioles so as to suggest a uniserial origin, and this is true also of the so-called pinnules of *Caryocrinites*, the ossicle in contact with the lower brachial being regarded the first.

The pinnulars of *Caryocrinites* are long and narrow in a direction parallel to the length of the pinnule, and are arranged in alternating series, as already indicated. The covering plates are long and narrow in a direction transverse to the length of the pinnule, about three or four occurring in the length of one pinnular.

The arms of *Caryocrinites* apparently varied in length. In an individual having a theca 30 millimeters in height, the arm nearest the left side of the anal opening has a length of 55 millimeters, while the second arm anterior to the latter, but on the same side, evidently was considerably longer since the part remaining, lacking the tip, is 75 millimeters in length. Possibly the posterior arms were shorter than the anterior arms also in other specimens.

The number of arms attached to the same theca varies in number in different individuals. In the youngest specimens, of which two occur in the Springer collection, the facets for 3 arms are distinctly developed. In one of the largest specimens, 14 arms are present. These are arranged in three groups, the anterior and left posterior groups including 5 arms, while the right posterior group includes only 4 arms. This varies in different individuals.

The question arises how and where the additional arms arise. It is noticed that in addition to the facets supporting the arms, the theca presents also smaller depressions, apparently for the attachment of appendages. Some of these depressions are traversed by a single median ridge placed in a radial direction, suggesting former articulation with some appendages. While no appendage actually ever has been found attached to these depressions it has been noticed that the order of appearance of these depressions is also the order of appearance of the additional arms, when a comparative study is made of the larger and smaller specimens of the same species. From this it is evident that these depressions are the points of emission of the additional arms.

Since similar depressions are present even in the largest specimens, and the position of these, of course, is never occupied by arms, it is possible that some of the later appendages were never strongly articulated with the theca, probably always remained comparatively small, and were specialized for the purpose of bearing the genital glands. Jaekel (Thecoidea und Cystoidea, 1899, p. 302, fig. 70) figures the relative position of the arm bases and of the smaller openings. Wachsmuth and Springer,(1881, Revision of the Palaeocrinoidea, Proc. Philadelphia Acad. Nat. Sci., vol. II, p. 51), long ago called attention to similar small depressions or pores at the sides of the arm facets of *Batocrinus*, and suggested respiratory purposes.

The area of attachment at the base of the column of *Caryocrinites* consisted of a more or less flattened expansion of small area, with a tendency toward radicular extensions at the margin, similar to the form of attachment of certain crinoid columns.

28. *Acknowledgments.*—The present paper could not have been written without the assistance of numerous individuals. The writer is under great obligation to the Director of the Geological Survey of Canada not only for the privilege of examining all of the specimens of *Comarocystites punctatus* preserved in the Victoria Memorial Museum at Ottawa, including the Billings types and the remarkable complete specimen presented to the Museum by Sir James Grant, but also for the excellent photograph of this complete specimen and for the enlarged photograph of that one of the Billings types preserving the pinnulate arm, here reproduced. To Mr. James E. Narraway and Mr. Walter Billings he owes not only the loan of the specimens figured on plate II, but also the use of other specimens, and valuable notes on the distribution of this species in the Ottawa area.

The types of *Comarocystites shumardi* and its so-called variety *obconicus* belong to the Worthen collection at the University of Illinois, and were loaned by Prof. T. E. Savage. The type of *Comarocystites shumardi* is here figured. Of the specimens of *Comarocystites shumardi* in the Walker Museum, at Chicago University, loaned by Prof. Stuart Weller, two are here figured. Of two specimens of the same species, belonging to the Illinois State Museum of Natural History, at Springfield, loaned by the curator, Dr. A. R. Crook, one is here figured.

The arm bearing specimens of *Caryocrinites ornatus*, preserving the pinnules, in the U. S. National Museum, at Washington, were placed at the disposal of the writer by Mr. Frank Springer, to whose collection they belong; and to his assistant, Mr. Herrick E. Wilson, the writer owes the excellent photographs of the pinnulate arms here reproduced. To all of these named the writer wishes to acknowledge the favors freely granted and gratefully received.

PLATE IV.

Fig. 1. Comarocystites shumardi, Meek and Worthen. Specimens No. 10974, belonging to Walker Museum, at Chicago University. A, anterior view of theca, specimen tilted so as to show the peristomial plates along the anterior side of the apical transverse food-groove. The quadrangular plate and the more pentagonal plate on its left margin correspond to the plates marked a, a, in the diagrams of Comarocystites punctatus. The mouth is situated at the posterior end of the suture between these plates. The branching of the transverse apical food-groove is indicated on the proximal side of the left stereom protuberance. The cavity occupied by the anal pyramid is seen on the left side of the figure. On the right side of the figure, the theca is defective. B, right side of same specimen, tilted so as to show the anal opening and the immediately adjacent thecal plates. For diagrammatic purposes the stellate grooving of the thecal plates has been accentuated and the remote (left) end of the apical transverse food-groove is represented as branched, although the specimen here is too imperfect to show this branching. C, posterior view of a second specimen, tilted so as to show the thecal plates on the posterior side of the transverse apical food-groove. The plate posterior to the middle of this apical food-groove corresponds to the plate marked rp in the diagrams of Comarocystites punctatus. From this plate the linear hydropore passes diagonally downward and toward the right, across the

suture, to the plate bordering on the posterior margin of the right stereom protuberance. The stellate grooving of the deeply concaved plates is clearly defined. The specimen is still partly imbedded in the rock. Kimmswick limestone, Cape Girardeau, Missouri. 1D, diagrammatic representation of arrangement of lamellae on interior surface of one of the thecal plates.

Fig. 2. Comarocystites shumardi, Meek and Worthen. Specimen No. 10472, in the Worthen collection at the University of Illinois. Type, used for figures 1a, and 1b, on plate I and diagram on page 292, Geol. Surv. Illinois, Vol. 3, 1868. Anterior side with the apical part flattened by pressure and depressed toward the left. The thecal plates surrounding the left pair of arms, as far down and including the anal pyramid, are missing. (Comarocystites shumardi obconicus forms No. 10473 in the Worthen collection). Cape Girardeau, Missouri.

Fig. 3. Comarocystites shumardi, Meek and Worthen. One of two specimens numbered 1574 in the Illinois State Museum of Natural History. Left anterior side of the theca, weathered away so as to expose the vertical mesostereom lamellae at the sutures separating the thecal plates. The stereom protuberance supporting the left pair of arms is located in the upper left hand corner of the figure, and the base of the theca lies beyond the opposite corner. The plate supporting this protuberance shows traces of the lamellae and of the inter-lamellar spaces connected with the respiratory system, corresponding to the more striking evidence of this system in the other plates. Three thecal plates are represented in the figure toward the right of the protuberance, both along the upper and lower margins of the figure. Each plate exposes two sets of lamellae, directed perpendicularly to two different suture lines. In each set, the lamellae extending from the middle of the suture lines are longer, and those nearer the angles of the thecal plate are shorter. The grooves separating the sets of lamellae belonging to the same plate from each other narrow toward the angles. The deep triangular pits at the angles of junction of the thecal plates produce a similar appearance. The sides of five additional plates are exposed in parts extending beyond the lower right hand corner of the figure, but these did not show up well in the photograph utilized in the preparation of this figure.

Fig. 4. Caryocrinites ornatus, Say. Arms with pinnules attached. Opposite the number 4, and near the base of the figure, are two pinnules which are entire.

Fig. 5. Caryocrinites ornatus, Say. A, arm with pinnules attached, only the basal parts of the latter well seen near the middle of the figure. Several of the larger brachials bear a strongly nodose protuberance. B, an adjacent arm of the same specimen, showing the granulate surface, and the pronounced alternation of longer and shorter brachials. Figures 4 and 5 are enlargements of specimens in the collection of Frank Springer in the U.S. National Museum, at Washington, and were prepared by Mr. Herrick E. Wilson.

PLATE V.

Comarocystites punctatus, Billings. Specimen retaining the entire length of the column, including the basal attachment disk (described on page 89 of present volume). Figure reduced to about eight-tenths of the natural size. Only the left arm in the figure is attached to the theca. The right arm may have belonged to another individual. Presented to the Victoria Memorial Museum by Sir James Grant, who published the first description and figure in 1880. (Trans. Ottawa Field-Nat. Club, 1, pl. 1, fig. 1.)

KILDEER PLOVER.

Ten years ago the Kildeer Plover (*Oxyechus vociferus*) was a rare summer resident in the Province of Quebec. During the past five seasons the bird has become very numerous and is now a common breeder, nearly one hundred nests having been found in the past four or five years. Several observers agree that the Kildeer is spreading rapidly throughout the Province, as in the case of the Meadowlark, which was also very rare a few years back.

The Killdeer usually arrives during the first week in April and a little later the birds have chosen their summer homes. Pebbly or rocky pastures and hillsides, near ponds, are their favorite grounds for nesting purposes. From April 24th to May 6th the set of three or four eggs may be found in such localities. The novice may have some difficulty in discovering the nest amongst pebbles and lichens so cunningly are the eggs placed and so well do they harmonize with their general surroundings; but the experienced eye can detect the eggs some yards off. The saucer-shaped nest is generally encircled by pebbles or stones and is lined with lichen, pieces of wood and weeds, manure and pebbles.' One nest was located amongst stones near a stone fence. One pair of birds were succssful in raising a brood alongside a wagon road running through a pasture.

During the mating season the birds are evidently nervous, as they make many attempts in excavating holes or nests in the ground, or perhaps these are only decoy nests. The real nest, however, is usually not very far away from such endeavors. In two instances the bird has been flushed off the nest a few feet away, but this is the exception rather than the rule. If one is watchful the bird may be seen running quietly away from the nest, but I believe the birds are off feeding most of the time, especially in bright, warm weather. The eggs have often been found with no birds in sight. Usually, however, they are very alert and soon make their presence known should anyone pass near the vicinity of the nest. After the nest is found it is rather amusing to watch the actions of the female. The bird, of course, is endeavoring to lead the intruder away and will squat down in some slight hollow in the ground as if she were about to settle on the nest, and will keep this performance up for some distance should she be successful in her efforts, returning to the nest by a circuitous route. I have only seen one bird feign a broken wing and turn somersaults, thus displaying the beautiful plumage of this species. The Killdeer raises at least two broods in a season.

W. J. BROWN.

BIRD NOTES.

By FRANK C. HENNESSEY, B.A.

RAPACITY OF THE BRONZED GRACKLE. (*Q. q. aeneus.*)

At Albion, Michigan, on May 25, 1916, and also on the 29th of the same month, I observed an action which, so far as I know, has not been attributed to the bronzed grackle.

While passing down a street of the suburbs of Albion, I noticed an English sparrow feeding in the dusty road. As I came within forty feet of it, a grackle, seemingly without provocation, swooped down from a nearby tree and fell upon this unsuspecting bird. With a succession of rapid blows the grackle killed the sparrow outright. Before I could prevent it, a friend who was with me ran out to drive off the grackle. The grackle was a male. On examining the bill and feathers of the dead sparrow, I found that this bird was not young, in fact, I am certain that it was mature. On plucking the sparrow I found that the neck and base of the skull were badly bruised. The injury seemed to indicate that it had been killed by sheer impact of blows.

On the other occasion my attention was caught by a great clamoring of English sparrows. A grackle in their midst was being pursued, and finally floundered into some nearby trees. A mature, dead sparrow was left behind on the road.

On both occasions, unfortunately, I was prevented from witnessing what the grackle would have done with its victim if left undisturbed. This, of course, deprives one of determining the significance of the action in question. My friends at Albion told me of witnessing two other instances of similar action by "blackbirds."

Restricted Breeding Communities of the Henslow's Sparrow.

From May 25 to June 2, 1915, at Barbee Lake, Kosciosko County, Indiana, and from June 2 to June 11, 1916, at Albion, Michigan, I had an opportunity of studying the Henslow's sparrow.

On both occasions the sparrows occurred in low, wet meadows. The interesting point to me is that although there were many spots identically the same as those frequented by the sparrows, the birds occurred at one spot only in both of the regions studied.

At Barbee Lake, Indiana, the birds were found only over an area of about one-quarter of a mile square, at the south end of the Lake. Here there were about twenty birds, and the conditions of the cloaca and the egg stages in the oviduct of the female specimens collected showed that they were on their breeding ground. The females were always in greater evidence than the males, and most of the birds collected were of this sex.

At Albion, Michigan, the birds were found only over an area of about one-half a mile square. I explored extensively the country about Albion to within a radius of seven miles of the town, and although this region abounded with suitable localities for the breeding of Henslow's sparrow, I found them only at one spot east of the town. I estimated that here there must have been from forty to sixty birds.

The question arises, do these observations tend to show that the species group during the breeding period?

EUROPEAN BUTTERFLY FOUND AT LONDON, ONT.

During the past few years Mr. John A. Morden, of London, Ont., has captured an unkown butterfly of a shaded orange colour, belonging to the skipper family. On sending it to the authorities at Washington it was determined as *Adopea* (*Pamphila*) *lineola.*

This European insect does not seem to have been previously reported from America. Mr. Morden first found it near the Dundas Street Bridge where refuse had been dumped. Possibly the eggs of the insect came from Europe with something that was thrown out and when hatched the larvæ found food in close proximity.

Mr. Morden says that the butterfly is now moderately common during July and is apparently spreading over the city.

The first capture was made July 21, 1910, when 10 specimens were taken, mostly worn. In 1911, most of the quack grass (*Agropyrum repens*) around the dump where the insects were taken had been killed and none were seen at that locality, but two were taken at Paul street not far away, in a waste lot overrun with quack grass.

Each year since then he has found them in a strictly wider area and, in 1914, one was taken in Hyde Park, five miles away.

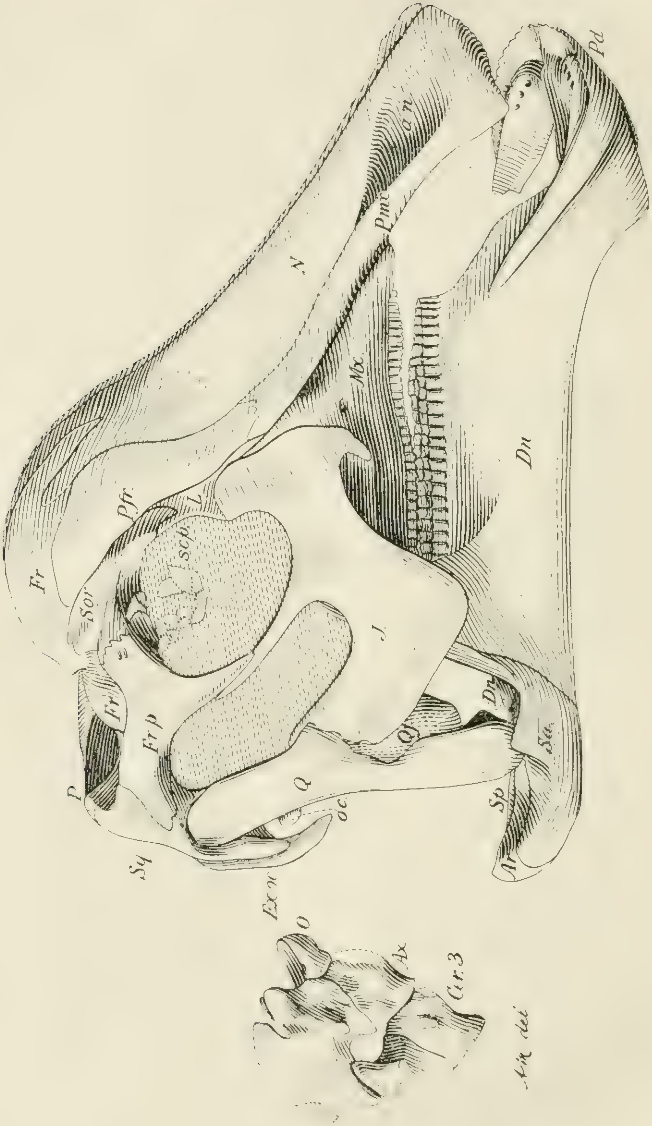
To Mr. A. A. Wood, Coldstream, who has been working on the matter in conjunction with Mr. John A. Morden, I am indebted for these facts.

W. E. SAUNDERS, London, Ont.

BOOK NOTICE.

"Water Powers of Manitoba, Saskatchewan and Alberta," issued by the Commission of Conservation, is a valuable contribution to the literature respecting the natural resources of Western Canada. This report, by Leo G. Denis and J. B. Challies, comprises the results of special surveys by the Commission of Conservation and a compilation of records from other reliable sources.

While the Prairie Provinces, as a whole, are not lavishly endowed with water-powers, the report demonstrates that the utility of their rivers for power development can be vastly enhanced through proper storage of flood waters. At present in the absence of conservation dams, and of adequate natural regulation, the great volume of flow is lost during high water seasons. Methods of development to ensure the maximum utilization are now being carefully worked out on the Winnipeg, Bow and other large rivers. The more northerly regions possess numerous sites of great potential value for pulp, electrochemical and other special industries.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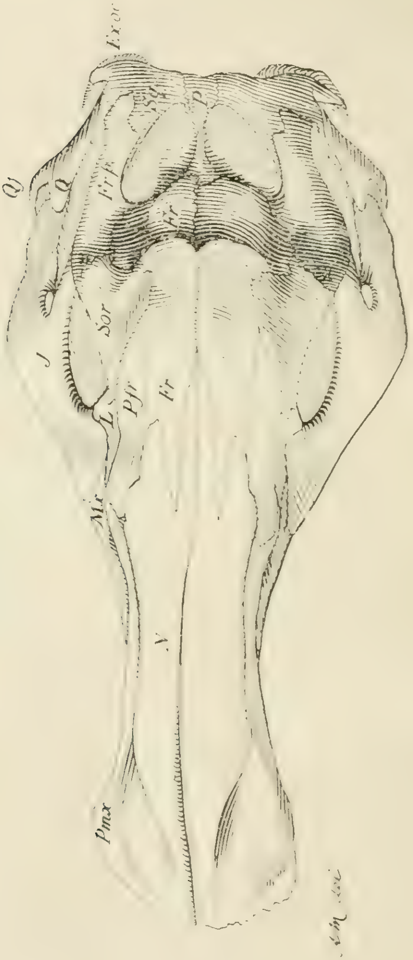
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ON CHENEOSAURUS TOLMANENSIS, A NEW GENUS AND SPECIES OF TRACHODONT DINOSAUR FROM THE EDMONTON CRETACEOUS OF ALBERTA.*

By LAWRENCE M. LAMBE, F.R.S.C.,
VERTEBRATE PALÆONTOLOGIST, GEOLOGICAL SURVEY OF CANADA.

The present paper is descriptive of the skull of a trachodont dinosaur of small size included in the Geological Survey vertebrate palæontological collection of 1915 from the Edmonton formation of Red Deer river, Alberta. The skull displays an assemblage of characters which clearly point to its belonging to a type generically distinct from any hitherto described member of the Trachodontidæ. With the skull, and belonging to the same individual, were limb bones, the pelvic arch, not altogether complete, vertebræ, and other parts of the skeleton (field No. 6, cat. No. 2246); a second skull belonging to a much smaller individual, was also obtained (field No. 2, cat. No. 2247) in beds of the same geological age. These remains were discovered by George F. Sternberg, in charge of the field party, about four miles apart in the valley of Red Deer river. The larger skull is from the west side of the river, about five miles above Tolman ferry, in sec. 11, twp. 34, range XXII, at 150 feet above the river level. This locality is roughly twenty-seven miles above the mouth of Three Hills creek, and eight miles west and somewhat north of Rumsey on the line of the Canadian Northern railway. The smaller skull was found farther up stream about one mile north-west of the mouth of Big Valley creek on the west side of the river.

The rock in which these remains occurred is a hard, very fine sandstone which is removed with difficulty from the bones. Mr. Sternberg has most successfully freed both skulls from their matrix, and has mounted the larger skull for exhibition. This larger skull is in an excellent state of preservation and is but slightly distorted. The sutures are very distinctly marked defining the exact limits of the various elements. The smaller skull is imperfect in the occipital region but elsewhere most of the sutures are clearly displayed; it is of special value for comparison with the larger specimen.

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*Communicated with the permission of the Deputy Minister of Mines.

The larger skull is selected as the type of the new genus for which the name Cheneosaurus (*Gr. Chencios*) is proposed on account of the supposed resemblance of the specimen, when viewed in profile, to the outline of the head of a goose. The species is named after Tolman ferry and post-office, both of which are not far from where the type was discovered.

CHENEOSAURUS TOLMANENSIS GEN. ET SP. NOV.

Generic and specific characters.—Skull small, high, short, dome-shaped above, and steeply descending in front. Domed prominence formed by frontals, nasals, prefrontals and supraorbitals. Lachrymal small. Nasals broad, covering the narial passages. Narial opening small and placed very far forward. Anterior premaxillary portion broadly expanded and terminating almost squarely in front. Mandible strongly decurved anteriorly. Teeth long and narrow, with marginal papillation at the apex to a varying extent. Orbit broadly ovate. Lateral temporal fossæ long and narrow. Supratemporal fossæ small.

This genus of the Edmonton formation differs from all other known members of the Trachodontidæ in the dome-shaped form of the upper, interorbital surface of the skull, and in the roofing over of the narial passages by the broad nasals, resulting in a diminution of the anterior nares and their limitation to a far advanced position. In no other form is the angle of descent of the facial portion so uniformly steep. Attention is called to the presence in Cheneosaurus of a large supraorbital, a cranial element not hitherto recognized in the Trachodontidæ except doubtfully in the single instance of Gryposaurus (Belly River formation).

The skull of *Cheneosaurus tolmanensis* is broad behind and narrow in front. It is most elevated in the region above the orbits and for a short distance forward, forming a conspicuous rotundity in the upper surface in advance of which it descends narrowly and steeply to the horizontally expanded snout. Behind the apical prominence the remainder of the superior surface is depressed. The mandible is long in comparison with its height and is strongly decurved in front where it ends in a broad predentary. The height of the type skull is less than three-fourths its length, and its maximum breadth is nearly one-half its length. The orbit is moderately large and is situated toward the front of the posterior half of the cranium.

By referring to the two drawings of the type, reproduced herewith, one a right side view, the other from above, the proportions of the different elements of the skull as they appear at the surface can be readily seen.

The dome-shaped prominence of the upper surface is formed by the frontals, prefrontals, nasals and supraorbitals. The frontal contribution is the largest of the four and occupies the greatest part posteriorly and superiorly, the prefrontals reach upward laterally, while the nasals assist anteriorly continuing backward slenderly between the frontals to the highest point of the dome. The supraorbitals contribute to a minor extent laterally behind.

The orbital opening is broadly ovate in outline with the more pointed end downward. It is bounded by the supraorbital, the postfrontal, the jugal, and the lachrymal, the last named element contributing least, and the postfrontal and supraorbital nearly equally to the formation of the rim.

The lateral temporal fossa is more than three times as high as wide and is enclosed in its lower half length by the jugal, and in the upper half by the quadrate, the postfrontal, and, to a slight extent, the squamosal.

The prefrontal is largely developed and is more than three times as long as broad. It lies in advance of the supraorbital and the lachrymal, is in contact above with the frontal, in front with the nasal, and below with the premaxilla which it overlaps.

The lachrymal is small and narrow, its extreme length being three times its maximum breadth. Its narrow upper end underlies the supraorbital while its posterior margin in its entirety enters into the formation of the orbital rim. Inferiorly it is in contact with the jugal and anteriorly with the prefrontal. Infero-anteriorly it is prolonged narrowly downward between the jugal and the prefrontal, the extreme end of the extension lying between the premaxilla and the maxilla.

The jugal does not present any very unusual characteristics. It is in contact with the quadrato-jugal and the quadrate behind, overlapping the former. In front it lies over a large surface of the maxilla, and supero-anteriorly is in contact with the lachrymal for a considerable distance. The end of its upwardly directed process, forming the lower half of the slender postorbital bar, passes behind the process from the postfrontal.

The premaxilla is a large bone broadly expanded horizontally outward in front where with its fellow it forms the edentulous anterior termination of the cranium. Postero-exteriorly it extends upward between the maxilla and the nasal as a long, narrow surface to meet the lower end of the prefrontal which overlaps it. The front border of the premaxilla curves outward and slightly backward from the midline of the skull and is met at an obtuse angle by the outer border descending freely from its contact with the maxilla. The upper surface of the bone is shallowly excavated in advance of the narial opening forming a slightly depressed area exterior to which the lateral angulation curves slightly downward. Anteriorly the thickness of the bone is suddenly increased on the lower surface a short distance back from the front edge. This edge is conspicuously notched by about from ten to twelve grooves which pass inferiorly backward across the thinned marginal area.

The nasal bones are contiguous along the midline of the cranium throughout their length, except possibly at their extreme anterior end. They are broad for the most part and curve downward outwardly to meet the premaxilla and the prefrontal. They arch over the nasal passages and their openings which latter are placed far forward. In advance of the openings the nasals continue narrowly forward for a short distance over the premaxillæ on either side of the midline, but the exact outline of their anterior ending is obscured. Posteriorly they appear to bifurcate, the exterior branch overlapping the frontal while the interior one continues, much attenuated, on the inner side of the frontal to the summit of the dome-shaped superior surface. This surface bifurcation of the nasal is not a division in reality, as the bone underlies the narrow front termination of the frontal.

A notable feature in the skull of Cheneosaurus is the presence of a large supraorbital bone which enters into the formation of the orbital rim almost to the same extent as the postfrontal. This bone is roughly subtriangular in shape and is in contact posteriorly with the postfrontal and frontal, superiorly with the frontal, and anteriorly with the prefrontal. Its lower edge for the most part forms the antero-superior portion of the curve of the orbital rim. Infero-anteriorly it extends narrowly downward and overlaps the upper end of the lachrymal.

The postfrontal has a somewhat larger surface area than the supraorbital and meets it anteriorly in a zigzagged suture. Posteriorly it overlaps the squamosal extensively. Superiorly its posterior half-length bounds the supratemporal fossa externally at the front, while the remainder of its upper half-length joins the frontal in a jagged suture.

The frontal is larger than the prefrontal, and is of an irregular shape. It is in sutural contact with the nasal, the prefrontal, the supraorbital, the postfrontal and the parietal. For nearly the whole of its anterior half-length it is separated from its fellow along the midline by the narrow backward extension of the nasals. It forms the greater part of the dome-shaped elevation of the cranium rising from behind, and descending on the anterior slope its forwardly directed attenuation overlaps the nasal. For a short distance forward from its junction with the parietal, equal to about one-fifth of its total length, its surface is lower than the part that rises into the dome-shaped prominence and is defined from it by an overhanging transverse fold of bone. This posterior area of the frontal is much depressed in its outer breadth but rises convexly inward to the mid-line. The suture between the pair is conspicuously zigzagged.

The supratemporal fossa is small, narrowly oval, and about twice as long as wide, and passes downward into the lateral temporal fossa. The two openings are close together posteriorly but toward the front they diverge from each other. They are bounded by the frontal, postfrontal, squamosal, and parietal, each of the four elements participating to an almost equal extent.

The squamosal runs forward beneath the postfrontal to a point in line with the anterior end of the supratemporal fossa. Intero-posteriorly it meets the parietal in a short jagged suture. Postero-inferiorly it is deeply cupped to receive the upper end of the quadrate, and sends downward a slender process which is applied to the paroccipital (exoccipital) alar extension in the usual way.

The occipital condyle is tripartite, the two exoccipitals and the basioccipital entering into its formation to an equal extent, with the bases of the exoccipital pair forming the upturned ends of the curved, U-shaped condylar surface.

The exoccipital in assisting in the formation of the condyle, bounds the foramen magnum laterally. A paroccipital process of large size supports the pendent extension of the squamosal from behind and passes freely downward beyond it.

The parietal bounds the supratemporal fossa on its inner side, and intero-anteriorly along the greater part of its sutural junction with the frontal. Postero-laterally it unites with the squamosal. Within the supratemporal fossate area the pair rise to each other at the median line together forming a narrow longitudinal ridge separating the openings.

The maxilla appears externally in contact principally with the premaxilla and the jugal. Superiorly it passes for a short distance between the jugal and the lowermost portion of the downward extension of the lachrymal.

The dentary supports a high and robust coronoid process, and is in contact posteriorly with the surangular to the extent usual in the Trachodontidæ. Its anterior edentulous portion is strongly decurved.

The teeth are of the general trachodont type, with the well known mode of vertical succession and replacement. They are best preserved in the right dentary where the inner enamelled surface is seen to be long and narrow, with a high median keel and raised margins. In this dentary the second tooth from the front has marginal papillations near the tip resembling the dental border sculpture of the small Belly River trachodont described from a maxilla under the name *Trachodon altidens* by the writer in 1902* The larger teeth toward the centre of the dental magazine appear to have their margins smooth or with only a slight indication of papillæ near the top. In the broadest part of the dental grinding surfaces there are generally two functional teeth in a transverse direction. The estimated number of teeth in the dentary in each vertical series near the midlength of the dental magazine is about three. There are about thirty-five vertical rows of teeth in the maxilla and thirty-three in the dentary. The above small Belly River form with long, narrow teeth may prove to be ancestral to Cheneosaurus.

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*Contr. to Can. Palaeont., vol. III (quarto), p. 76, pl. IV, figs. 2, 3 and 4.

The predentary was missing in the type skull but has been restored, as figured, principally from the smaller skull, in which this bone was preserved. As in the premaxillæ the front margin is coarsely notched, indicating the probable presence in life of a firmly attached, strong, horny covering to the beak-like termination of the jaws.

About thirteen sclerotic plates are wholly or partially preserved in the upper part of the orbital opening. The ring in which these plates occurred in life is clearly indicated but its symmetry is destroyed and the full number of plates may not be represented.

With the skull are figured the odontoid process, the axis, and the third cervical vertebra which were found in place. The remaining parts of the atlas were missing.

MEASUREMENTS OF THE TYPE SKULL OF CHENEOSAURUS TOLMANENSIS.

	Mm.
Length of cranium from anterior end of premaxillæ to occipital condyle	445
Length of cranium from anterior end of premaxillæ to posterior border of exoccipital process	477
Height of skull, as mounted, from lower surface of dentary vertically upward to highest point of upper surface	308
Distance from lowermost portion of jugal to highest point of superior surface of skull	276
Distance from grinding surface of maxillary teeth to highest point of skull	229
Anterior premaxillary breadth from midline of skull to outer angulation (half breadth of snout)	97
Length of quadrate (slightly restored at lower end)	190
Extreme length of mandible (predentary restored, articular restored)	473
Length of dentary	358
Depth of dentary, at about midlength of mandible, from outer alveolar border to lower edge	64
Maximum breadth of predentary (restored)	151
Maximum height of orbit	99

Maximum width of same	79
Length of lateral temporal fossa	140
Width of same at midlength	42
Length of supratemporal fossa	64
Width (transverse) of same	30
Length of maxillary dental grinding surface	175
Enamelled surface of tooth, about to become functional, in fourteenth vertical row from the front, in right dentary:	
Length	32
Breadth	7

The figures of the two accompanying plates are from drawings by Mr. Arthur Miles.

EXPLANATION OF PLATES.

Plate VI.—Right lateral aspect of skull (type) of Cheneosaurus tolmanensis; one-fourth the natural size. To bring the vertebrae clearly into view they are represented two and a half inches back of their proper position.

Plate VII.—Superior aspect of the same skull; one-fourth the natural size.

Abbreviations.—Ar, articular; Ax, axis; Cer. 3, third cervical vertebra; Dn, dentary; Ex. oc., exoccipital; Fr, frontal; Fr. p., postfrontal; J, jugal; L, lachrymal; Mx, maxillary; N, nasal; O, odontoid process; P. parietal; Pd, predentary; P.fr., prefrontal; Pmx, premaxillary; Q, quadrate; Qj, quadrato-jugal; Sa, surangular; Sor, supraorbital; Sp, splenial; Sq, squamosal; a.n., anterior nares; o.c., occipital condyle; sc.p., sclerotic plates.

BIRDS OF LAKE ONIGAMIS REGION, QUE., AND ALGONQUIN PARK, ONT.

BY JOHN M. COOPER, WASHINGTON, D.C.

INTRODUCTORY REMARKS.

The following two lists of birds were received by the undersigned from the Rev. John M. Cooper. As they apply to districts from which we have little exact information, I requested and received permission from the author to publish them.

Mr. Cooper informed me that in neither locality were specimens taken, and while the species are undoubtedly correct the sub-specific designations rest only upon the probabilities of known geographical distribution. It is refreshing to find an observer who realizes the difficulties of sub-specific identification and the advisability of making such an explanation.

The list at the end of the Onigamis list of birds that were expected but not seen is also a feature worthy of being repeated in other such work.

P. A. TAVERNER.

Birds Observed in Lake Onigamis Region and Upper St. Maurice River, Quebec, Between 48° and 49° N. Lat. and 73° 45′ and 75° 30′ W. Long., June 9-22, 1916.

Loon, *Gavia immer* Brunn.; not common.
Herring Gull, *Larus argentatus* Pont.; common.
Black Duck, *Anas rubripes* Brewst.; common.
Great Blue Heron, *Ardea herodias herodias* Linn.; rare.
Spotted Sandpiper, *Actitis macularia* Linn.; common.
American Osprey, *Pandion haliaëtus carolinensis* Gmel.; not common.
Great Horned Owl, *Bubo virginianus virginianus* Gmel.; common.
Kingfisher, *Ceryle alcyon* Linn.; common on St. Maurice River.
Yellow-bellied Sapsucker, *Sphyrapicus varius varius* Linn.; common.
Northern Flicker, *Colaptes auratus luteus* Bangs; common.
Night Hawk, *Chordeiles virginianus virginianus* Gmel.; common.
Olive-sided Flycatcher, *Nuttallornis borealis* Swains.; common.
Least Flycatcher, *Empidonax minimus* W. M. & S. F. Baird; common.
Canada Jay, *Perisoreus canadensis canadensis* Linn.; common.
Northern Raven, *Corvus corax principalis* Ridgw.; common.
Crow, *Corvus brachyrhynchos brachyrhynchos* Brehm.; not common.
White-throated Sparrow *Zonotrichia albicollis* Gmel.; abundant.
Slate-colored Junco, *Junco hyemalis hyemalis* Linn.; common.
Song Sparrow, *Melospiza melodia melodia* Wils.; common.
Tree Sparrow, *Iridoprochne bicolor* Vieill.; abundant.
Red-eyed Vireo, *Vireosylva olivacea* Linn.; abundant.
Nashville Warbler, *Vermivora rubricapilla rubricapilla* Wils.; not seen, but heard distinctly at close range near Lake Asawewasenan; am reasonably certain of identification, being quite familiar with its distinctive song.
Yellow Warbler, *Dendroica aestiva aestiva* Gmel.; abundant especially along St. Maurice River.
Myrtle Warbler, *Dendroica coronata* Linn.; common.
Black-throated Green Warbler, *Dendroica virens* Gmel.; common.
Oven Bird, *Seiurus aurocapillus* Linn.; not common.
Water Thrush, *Seiurus noveboracensis noveboracensis* Gmel.; not common in lake region, abundant along river.
Redstart, *Setophaga ruticilla* Linn.; common.
Winter Wren, *Nannus hiemalis hiemalis* Vieill.; not common.
Red-breasted Nuthatch, *Sitta canadensis* Linn.; common.
Olive-backed Thrush, *Hylocichla ustulata swainsoni* Tschudi; abundant.
Hermit Thrush, *Hylocichla guttata pallasi* Cab.; not common.
Robin, *Planesticus migratorius migratorius* Linn.; not common.
Merganser, *Mergus* was common, but not seen at close enough range to tell whether *americanus* or *serrator*. Several other species

present were observed or heard but not distinctly enough for unmistakable identification. I hope to renew observations in the same region this coming June.

None of the following birds were seen or heard:

Whip-poor-will, *Antrostomus vociferus* Wils.
Chimney Swift, *Chaetura pelagica* Linn.
Barred Owl, *Strix varia* Barton.
Goldfinch, *Astragalinus tristis* Linn.
Catbird, *Dumetella carolinensis* Linn.
Brown Creeper, *Certhia familiaris americana* Bonap.
Chickadee, *Penthestes atricapillus* Linn.
Veery, *Hylocichla fuscescens* Steph.

BIRDS OBSERVED IN ALGONQUIN PARK, ONTARIO, JUNE 2-19, 1908-14.

Loon, *Gavia immer* Brunn.; abundant; nests often, once June 10, 1911, at Tea Lake; young not out by June 19 of any of above years.

Herring Gull, *Larus argentatus* Pont.; abundant; nests often, usually on little rocky islets; young June 13, 1914.

Common Tern, *Sterna hirundo* Linn.; one seen on Lake Opeongo; seen at fairly close range, grayish underparts clearly observed.

Black Duck, *Anas rubripes* Brewst.; common; nests several times.

Bittern, *Botaurus lentiginosus* Montag.; not common.

Great Blue Heron, *Ardea herodias herodias* Linn.; common; heronry observed at Magnetewan Lake, 12 nests in 4 tall pines, probably 30-50 feet above ground; there are said to be other heronries near Potter Lake and on Maggie's Lake.

Spotted Sandpiper, *Actitis macularia* Linn.; common; nests; young observed June 19, 1914.

Canada Spruce Partridge, *Canachites canadensis canace* Linn.; fairly common; young seen June 11, 1913, near Phillips Lake.

Canada Ruffed Grouse, *Bonasa umbellus* (presumably *togata*) Linn.; common.

Broad-winged Hawk, *Buteo platypterus* Vieill.; common.

Bald Eagle, *Haliæetus leucocephalus* Linn.; distinctly seen at close range at Clear Lake.

Sparrow Hawk, *Falco sparverius sparverius* Linn.; fairly common.

Osprey, *Pandion haliaëtus carolinensis* Gmel.; common; nests seen several times, always in large dead trees, at top about 40 feet from ground.

Barred Owl, *Strix varia varia* Barton; abundant.

Saw-whet Owl, *Cryptoglaux acadica acadica* Gmel.; fairly common; not seen but heard at times; identification rests partly on guide who without any suggestive questions on my part told me he had the previous year searched for, caught and learned the name of bird; we heard the oft repeated sort of whistle quite distinctly on several occasions.

Belted Kingfisher, *Ceryle alcyon* Linn.; common; nests.

Hairy Woodpecker, *Dryobates villosus* (presumably *villosus*) Linn.; common; nests.

Downy Woodpecker, *Dryobates pubescens* (presumably *medianus*) Swains.; not common.

Arctic Three-toed Woodpecker, *Picoides arcticus* Swains.; fairly common; am fairly but not absolutely certain of identification; usually observed under somewhat imperfect light conditions; was told on good authority that both *arcticus* and *americanus* are in Park.

Yellow-bellied Sapsucker, *Sphyrapicus varius varius* Linn.; common.

Northern Pileated Woodpecker, *Phloeotomus pileatus* (presumably *abieticola*) Bangs; fairly common.

Northern Flicker, *Colaptes auratus luteus* Bangs; common; nests.

Whip-poor-will, *Antrostomus vociferus vociferus* Wils.; locally abundant.

Night-hawk, *Chordeiles virginianus virginianus* Gmel.; common.

Chimney Swift, *Chaetura pelagica* Linn.; abundant.

Ruby-throated Hummingbird, *Archilochus colubris* Linn.; fairly common.

Kingbird, *Tyrannus tyrannus* Linn.; abundant; nests seen were in majority of cases (5 out of 7) on tops of dead stumps, 2½-5 feet up from water level.

Phoebe, *Sayornis phoebe* Lath.; uncommon, several seen, one at Cedar Lake.

Olive-sided Flycatcher, *Nuttallornis borealis* Swains.; abundant.

Wood Pewee, *Myiochanes virens* Linn.; common.

Least Flycatcher, *Empidonax minimus* W. M. and S. F. Baird; common; nest.

Blue Jay, *Cyanocitta cristata cristata* Linn.; common.

Canada Jay, *Perisoreus canadensis* Linn.; common; young about full size in early June.

Northern Raven, *Corvus corax principalis* Ridgw.; not common.

Crow, *Corvus brachyrhynchos brachyrhynchos* Brehm; uncommon.

Red-winged Blackbird, *Agelaius phoeniceus phoeniceus* Linn.; abundant.

Bronzed Grackle, *Quiscalus quiscula aeneus* Ridgw.; abundant.

Purple Finch, *Carpodacus purpureus purpureus* Gmel.; common.

Goldfinch, *Astragalinus tristis tristis* Linn.; common.

Vesper Sparrow, *Pooecetes gramineus gramineus* Gmel.; common in clearings.

White-throated Sparrow, *Zonotrichia albicollis* Gmel.; abundant.

Chipping Sparrow, *Spizella passerina passerina* Bech.; common in clearings.

Slate-colored Junco, *Junco hyemalis hyemalis* Linn.; common.

Song Sparrow, *Melospiza melodia melodia* Wils.; abundant; nests.

Swamp Sparrow, *Melospiza georgiana* Lath.; common.

Rose-breasted Grosbeak, *Zamelodia ludoviciana* Linn.; rare; seen only once, at Victoria Lake.

Indigo Bunting, *Passerina cyanea* Linn.; rare; seen and heard only once, at Victoria Lake.

Scarlet Tanager, *Piranga erythromelas* Vieill.; common in all parts of Park, including the extreme northern part around Tea Lake.

Barn Swallow, *Hirundo erythrogaster* Bodd.; common; nests.

Tree Swallow, *Iridoprocne bicolor* Vieill.; abundant; nests.

Bank Swallow, *Riparia riparia* Linn.; uncommon; seen at Manitou Lake.

Cedar Waxwing, *Bombycilla cedrorum* Vieill.; common.

Red-eyed Vireo, *Vireosylva olivacea* Linn.; abundant.

Blue-headed Vireo, *Lanivireo solitarius solitarius* Wils.; fairly common.

Black and White Warbler *Mniotilta varia* Linn.; common.

Nashville Warbler, *Vermivora rubricapilla rubricapilla* Wils.; abundant, in second growth chiefly.

Northern Parula Warbler, *Compsothlypis americana usneae* Brewst.; common, even in northern and northwestern part of Park.

Yellow Warbler, *Dendroica aestiva aestiva* Gmel.; rare, seen and heard only once, at Cache Lake.

Black-throated Blue Warbler, *Dendroica caerulescens caerulescens* Gmel.; common.

Myrtle Warbler, *Dendroica coronata* Linn.; abundant; nests.

Magnolia Warbler, *Dendroica magnolia* Wils.; common.

Chestnut-sided Warbler, *Dendroica pensylvanica* Linn.; common, especially in second growth.

Blackburnian Warbler, *Dendroica fusca* Mull.; common in northern part as well as in southern part.

Blackthroated Green Warbler, *Dendroica virens* Gmel.; common.

Pine Warbler, *Dendroica vigorsi* Aud.; rare, seen only once, at Proulx Lake; grayish yellow underparts, grayish neck and head, tail feathers tipped with white and two white wing bars seen well; song (rather sharp-cut trill) heard distinctly; am reasonably certain of identification.

Oven-bird, *Seiurus aurocapillus* Linn.; common, especially among maple.

Water Thrush, *Seiurus noveboracensis noveboracensis* Gmel.; common.

Mourning Warbler, *Oporornis philadelphia* Wils.; common.

Maryland Yellow Throat, *Geothlypis trichas trichas* Linn.; common.

Canada Warbler, *Wilsonia canadensis* Linn.; common.

Redstart, *Setophaga ruticilla* Linn.; abundant.

Catbird, *Dumetella carolinensis* Linn.; rare; observed only twice, once at Opeongo Lake, and once at Island Lake.

Brown Thrasher, *Toxostoma rufum* Linn.; rare; one observed in Park at Joe Lake and two on outskirts of Park near South River and Egan Estate.

House Wren, *Troglodytes aëdon aëdon* Vieill.; common.

Winter Wren, *Nannus hiemalis hiemalis* Vieill.; abundant.

Brown Creeper, *Certhia familiaris americana* Bonap.; not common; nest seen once, at Canoe Lake, in bark of large dead hemlock in floodwater about three feet up from water level; at distance of about five yards heard its rather melodious song, a clear high-pitched whistle of five distinct notes, and first and third long, the other three short.

Red-breasted Nuthatch, *Sitta canadensis* Linn.; common.

Chickadee, *Penthestes atricapillus atricapillus* Linn.; common.

Golden-crowned Kinglet, *Regulus satrapa satrapa* Licht.; rare; seen only once, at Merchant's to White Trout Lake portage.

Wood Thrush, *Hylocichla mustelina* Gmel.; not common; never seen, but heard pretty clearly on several occasions; once when heard a half-breed at Manitou Lake with whom I was talking at the time told me the bird had a 'red head.'

Veery, *Hylocichla fuscescens fuscescens* Steph.; fairly common.

Olive-backed Thrush, *Hylocichla ustulata swainsoni* Tschudi; abundant; nests.

Hermit Thrush, *Hylocichla guttata pallasi* Cab.; faily common.

Robin, *Planesticus migratorius migratorius* Linn.; not common; nest.

Bluebird, *Sialia sialis sialis* Linn.; uncommon.

1. Mr. Bartlett, the Park Superintendent, has in his office a specimen of the Golden Eagle, *Aquila chrysaëtos*; the bird took wolf poison near Tea Lake (Big Tea in n. part of Park) the winter of 1908-9.

2. Mr. Waters, one of the older rangers, and a man who knows the Algonquin birds perhaps better than any one else, told me that the Great Horned Owl, *Bubo virginianus virginianus* Gmel. is found in the Park.

3. Dr. Claghorne, a former forest ranger, told me that he had seen the Baltimore Oriole, *Icterus galbula* Linn., near Cache Lake in the spring of 1911 and had found the Cliff Swallow, *Petrochelidon lunifrons lunifrons* Say, on the Madawaska River.

4. The Alder Flycatcher, *Empidonax trailli alnorum,* and the Yellow-bellied Flycatcher, *E. flaviventris,* probably both breed in the Park, but I have never been sufficiently sure of their songs and would not feel safe in identifying them in the bush.

5. *Mergus,* common, but whether *americanus* or *serrator* am uncertain. Oddly enough have never observed a male in the Park, though the female was seen nearly every day.

6. A grebe with young seen once; presumably Pied-billed Grebe *Podilymbus podiceps,* but male was not observed, so could not be sure of identification.

7. I have noted in above list cases where nests have been found; judging from the dates when birds themselves were observed, it is most likely that all the birds in the list nest in the Park.

NOTES ON THE FEEDING HABITS OF TWO SALAMANDERS IN CAPTIVITY.

BY CHARLES M. STERNBERG, GEOLOGICAL SURVEY, OTTAWA.

While attending an excursion of the Ottawa Field-Naturalists' Club to Cache Bay, on the Ottawa River, about two miles above Hull, P.Q., on May 13 last, the writer was fortunate enough to capture two salamanders, *Amblystoma punctatum* (the spotted salamander), and *Amblystoma Jeffersonianum,* as well as a newt,*Diemictylus viridescens.* The habits of the salamanders have since been observed. They were all placed together in a box, with a screen netting on the top, and with damp earth, moss, and rotten wood in one corner. Under this they crept and have since remained, (with the exception of the newt) apparently much at home.

The newt refused to eat from the first and died in July, but the salamanders readily ate earth and other worms, crickets, house flies, and other soft insects. They refused however to eat small grasshoppers, spiders, and insects with hard wing covers, such as the Lady Birds and other small beetles. Dead worms left in the box were not eaten, but on one occasion a small strip of fresh pork, moved to imitate the action of a live worm, proved sufficiently attractive to one of them. Like many of the lower forms of vertebrates, salamanders can live without food for several weeks with apparently no discomfort; then they make up for lost time by gorging themselves. This was proven on one occasion when, after being without food for about five weeks, each ate three angle worms before they were satisfied. They began by catching a worm near one end and then by a succession of quick snaps taking a fresh hold, each time about one-fourth of an inch ahead, they gradually swallowed it. These movements were very rapid but the interval between bites varied and sometimes they waited as long as half a minute before continuing. On one occasion the two salamanders took hold of opposite ends of a very large angle worm and began to devour it, each being apparently ignorant of the other's action until they approached each other near the middle of the worm; then each pulled and jerked but could not loosen each other's hold. Neither had they strength enough in their jaws to sever the worm with their teeth. When about half an inch apart, after much backward jerking and pulling, the smaller one,(*A. Jeffersonianum*) suddenly rolled over three times in an effort, no doubt, to twist the worm in two. Not succeeding in this it made a second attempt, rolling over only twice this time, but still without success. These turns were always made to the right and very rapidly. (The alligator resorts to the same practice, but its movements are relatively slow). The second attempt having failed the smaller salamander loosened its hold and the larger one took possession of the worm, even the portion which the smaller one had already swallowed. At another time the smaller one was offered one end of a worm, which it took while the writer held the other end firmly. When it had swallowed nearly the entire worm it pulled and jerked, trying very hard to break or tear it in two. Failing to do this it rolled over and over as it had done on the previous occasion, though a greater number of times, and with such rapidity that the turns could not be counted. In this attempt it was successful.

Both captives have continued to grow, the larger one (*A. punctatum*) having increased from four inches in length, when collected, to five and one-eighth inches at the present time (Jan. 1917), and the other from about three inches to four inches.

CONCERNING SOME ONTARIO CRAYFISHES.

By A. G. Huntsman, B.A., M.B.
Biol. Dept., University of Toronto.
Curator of the Atlantic Biological Station, St. Andrews, N.B.

The crayfish or 'crab' as it is often wrongly called, is abundant in nearly all our waters, but there is comparatively little known concerning the species occurring in Canada and their distribution. As they are used regularly for teaching purposes in our higher schools and are easily captured and preserved, specimens and data as to distribution could readily be collected by anyone interested.

There are considerable difficulties in the matter of identification, owing to the specific differences being slight and often inconspicuous. Those desirous of studying this group of animals I would refer to the works of Faxon (A Revision of the Astacidae. Mem. Mus. Comp. Zool. Harv., vol. X, No. 4, 1885) and Ortmann (Proceed. Amer. Phil. Soc., vol. XLIV, p. 91, 1905)* for keys for the determination of the species.

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*Also "The Fresh-water Malacostraca of Ontario" in Contr. Canad. Biol., Suppl. 47th Ann. Rep. Dep. Marine and Fisher., Fisheries Branch. 1915.

I shall be very glad to receive any information concerning our crayfishes or to assist anyone in the identification of specimens. Whenever possible, specimens should be kept, together with records of the locality and habits.

All our crayfishes east of the Rocky Mountains belong to the genus *Cambarus*, and we have at least eight species. The most interesting ones are those that dig out burrows for themselves in the mud. The material excavated is usually left at the opening of the hole as a 'chimney' of mud, which may be several inches in height. These 'chimneys' are frequently seen in low ground or on the banks of streams.

Recently I took occasion to investigate some of these burrows that are quite abundant in the clay banks of the Twenty-Mile Creek, near Tintern, in the Niagara Peninsula. The species that inhabits these burrows proved to be *C. immunis*, which has not previously been recorded from Canada. It is abundant in Ohio, southern Michigan, and farther south and west. The present record places it in the drainage area of Lake Ontario.

All the specimens very evidently belonged to *C. immunis*, but without exception they showed the presence of small lateral rostral spines, which are only occasionally found in this species. In this respect they agree with Faxon's variety *spinirostris*. The excavation at the base of the movable finger of the large claw was not invariably present, being absent on one or other side in three specimens (two males and one female). This species is most easily recognized by the condition of the first pair of abdominal legs of the male. The two branches of each leg are long and slender and curved so as to form at least one quarter of a circle.

The banks of the stream, where the burrows were situated, were of a stiff blue clay. I believe that the stream never becomes wholly dry. There is not then the same necessity for the crayfish to burrow, as in the case of those inhabiting swamps and pools that become dry in the summer months. Ponds and ditches of this sort are given as the usual habitat of this species.*

None of the burrows showed well-formed chimneys when I examined the spot (September). They had apparently been destroyed by passing animals or by the weather. The burrows were not built in any regular fashion, but varied greatly. Each had either one or several openings. The openings were sometimes all on the bank above water, at other times some above and some below, and apparently, sometimes all below. The level of the water varies during the season and at times all the openings would probably be exposed.

The length of the burrows varied from half a foot to several feet. Sometimes they were nearly straight, but usually they were quite tortuous. Their direction varied from horizontal or slightly upward to vertically downward.

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*See Harris, Amer. Natural., vol. 35, p. 187.

I was not able in any case to demonstrate a special shelf on which the animal rested, although the end of the burrow or of one of the side branches might be enlarged into a chamber.

Sometimes the crayfish was easily caught without digging out the entire burrow. If the entrance were opened out, and the open hand placed in it in the muddy water, the crayfish usually came up into my hand in a few minutes.

The irregularity in the burrows is doubtless due to the burrows having been constructed in different seasons and at times of different water levels. Separate burrows would frequently become connected into one, thus giving more than one opening. The variation shown in the direction of the burrow would be caused by local differences in the nature of the bank, the presence of stones and other hard materials.

Burrows in the bed of a small stream running into the Credit River near Port Credit, were found to contain the large species, *C. bartonii robustus.* In this case also, there was no regularity in the mode of construction. The majority of the openings were in the middle of the bed of the stream and under water. This species does not ordinarily burrow, but is to be found underneath large stones. The scarcity of stones and the small size of the stream (drying up at times?) doubtless forced the crayfish to burrow.

BIRD NOTES.

OCCURRENCE OF THE RING-NECKED PHEASANT IN THE VICINITY OF MONTREAL.

At Dumouchel's taxidermy shop, on October 10, I saw a male Ring-necked Pheasant in the flesh, which had been shot at Ormstown, on October 8, by Mr. Dionne. Another bird seen at the same time, concerning which I could obtain no data, was probably shot in the vicinity of Montreal. The necks of both birds were distinctly ringed with white. These are the first records I know of for this locality.

BIRDS AFFECTED BY ARTIFICIAL LIGHT.

St. Lambert has recently acquired a new system of street lighting which makes the streets much brighter than formerly. About 9 p.m. on November 2, I heard a commotion in a maple tree and discovered two European Sparrows amongst the foliage. I watched them for several minutes, moving about and chirping quite naturally in the brilliant glare of a neighboring lamp, with no apparent intention to retire. It is well illustrated, in the 'gay white ways' of cities, how man has been induced to turn night into day, but this is the first instance I have noticed amongst day-feeding birds. Perhaps it is natural that the adaptive 'sparrow' should be the first to adopt this bad habit.

L. McI. TERRILL, St. Lambert, Que.

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NOTES ON SOME OTTAWA DISTRICT PLANTS.

By W. Hague Harrington, F.R.S.C.

My former contributions to The Ottawa Naturalist having been chiefly of an entomological nature, it may appear presumptuous for me to offer a botanical one, but the following explanation may serve as my excuse and apology. About ten years ago it became evident that the insect studies, to which much of my spare time was then largely devoted, would be materially aided by a fuller acquaintance with the flora of the district. The identification of plants on which insects were captured would then be speedier and more satisfactory, and errors would be avoided to a greater degree. A partial knowledge of our flowering plants had already been obtained at outings and botanical meetings of The Ottawa Field-Naturalists' Club, and more especially from rambles with Prof. Macoun and the late Dr. Fletcher. The latter had been my instructor and co-worker since 1877 in these studies and his wide knowledge of botany was ever at my disposal in any difficulties. It seemed, however, time to have a more systematic knowledge of our plants, and a collection of them for reference. During all available time for several seasons close examinations were made of the surrounding district, especially the section northward from the Ottawa river to Aylmer, Kingsmere, Chelsea and beyond. The resulting collections eventually included nearly all the plants of the Flora Ottawaensis, and the majority of them were examined and had the determinations verified by Fletcher. Some species afterwards collected, especially grasses, were kindly named by Prof. Macoun and J. M. Macoun. On the issue of Gray's New Manual of Botany, the collection was arranged and labelled in conformity therewith, and a list was kept of some species which seemed of special interest. The list, with some notes, was then intended for publication in The Ottawa Naturalist, but was withheld in view of the proposed issue of a revised Flora Ottawaensis. That has not yet appeared and it is hoped that these notes may still have some interest and possible value. The subjoined list of fifty species includes some unrecorded ones, which our botanists may have also collected, as well as some of the rarer forms, and some plants which may have become extinct, or which are disappearing through the destruction of their habitats. The most interesting and attractive collecting grounds were those among the rocks and ravines of the Kingsmere hills. It was to King's Mt. that the first delightful excursion of the Ottawa Field-Naturalists' Club was made, on May 22, 1879, and although nearly two-score summers have since enriched the varied scenes, there still survive some of those who enjoyed that enthusiastic outing. Yearly since then some have climbed the winding path to the mountain top and garnered fresh treasures, but still there remain discoveries to reward the careful seeker. It is above all a place for outlook and meditation, where from the bald rocks of the summit, or the shade of some fair tree, one may gaze forth over the farspread plain below, with its farms and hamlets, and the towers of the busy city beyond the river, and try to picture and realize the wonders of the primeval ocean that beat about its base in the days of yore.

Selaginella rupestris (L.) Spring. Creeping Selaginella.

On dry rocks on the summit of King's Mountain, Kingsmere, P.Q.; collected on Sept. 11, 1910, being then much dried up. This moss-like humble plant occurs in similar situations along the high western escarpment of the mountains. In 1914, it was observed to be abundant on the rocky slopes of the Okanagan hills opposite Peachland, B.C.

Isoëtes echinospora Dur. (?) Quillwort.

Somewhat abundant on marshy river front (much trampled by cattle) near Deschenes, P.Q., Aug. 1, 1908.

Isoëtes sp.

A smaller plant, but possibly the same species, growing in Meech Lake, P.Q., in water over one foot in depth; Aug. 19, 1906.

Eriocaulon articulatum (Huds.) Morong. Pipewort.

At Lake La Peche, P.Q., (locally known as Wilson's Lake) an emersed form of this species was collected on July 17, 1910, on a sandy shore, the fruited stems being from two to four inches high. Nearby was a turtle's nest containing a large number of empty eggs. The usual form of this pipewort was abundant in Meech Lake, Aug. 14, 1910, in water varying in depth from one foot to three or four feet. The stems generally projected above the water several inches and at the water line were thickly encrusted with a black band an inch or more wide composed of the eggs of some aquatic insect. In the adjoining Harrington Lake, usually miscalled Mousseau's Lake, the plant grows in still deeper water with flowers floating on the surface.

Mediola virginiana L. Indian Cucumber-root.

This plant attracts attention by its tall floculent stem with a central whorl of large pointed leaves, usually about six in number, and a terminal whorl of smaller leaves from which depend the small lily-form flowers on slender pedicels. The most prolific localities for it are the rich woods of the Laurentian Hills. Kirk's Ferry, P.Q., flowers and fruit, July 6, 1905; Cascades, P.Q., flowers, June 19, 1906.

Habenaria flava (L.) Gray. Small Pale Green Orchis.

The habitat of this plant is a marshy river-front where its pale green spike of blossoms is inconspicuous amid the sedges and other plants among which it is dispersed. On July 5, 1906, it was found in some abundance on the shore near the Country Club, P.Q., and on July 21, 1907, in the same locality it was less numerous, having been badly trampled by cattle which seek the river either to drink or stand in the water, and destroy much of the littoral vegetation.

Habenaria psycodes (L.) Sw. Smaller Purple-fringed Orchis.

The tall purplish spikes of bloom appear some seasons in great abundance and beautify the low meadows and roadsides which are their usual habitat. The Beaver Meadow, Hull, P.Q., was often richly adorned in July with these charming plants but, alas! the devastation and ravages of the extensions of Hull are fast destroying the beautiful scenes to which the Field-Naturalists' Club frequently resorted to study the rich fauna and flora. The winding creek overshadowed by stately elms, with all the wealth of bloom which made gay the luscious meadow, and the many rare plants, which combined to make this area so enticing to the botanist and constituted it a profitable collecting ground for the entomologist and a rich reserve for the bird lovers, are vanishing. Collected at Chelsea, P.Q., July 9, 1905, and Hull, July 15, 1905.

Habenaria fimbriata (Ait.)R. Br. Large Purple-fringed Orchis.

This species is distinguished from the preceding by its larger and paler blossoms and is much more local and rare. The best locality known to me was a small area of springy ground near a cedar swamp in the deep woods north of Chelsea, but this habitat will probably have been destroyed by the fires which followed the cutting down of the beautiful forest. Instead of grateful shade and lovely woodland vistas, there are left the crumbling rocks denuded of soil and desolate with the blackened trunks and stumps of the forest monarchs. Plants collected in the locality described on July 1, 1906, and July 7, 1907. An unusually large and massive spike was found on July 1, 1906, on the edge of the railway ditch near Kirk's Ferry. Unfortunately these beautiful flowers do not preserve their colours well when dried, and do not make such attractive sheets as those of Pogonia, Calapogon and Arethusa.

Spiranthes lucida (H. H. Eaton) Ames. Wide-leafed Ladies' Tresses.

This is one of our rarest orchids and only two plants were found. The first was in flower on July 2, 1905, on the wet river-front below the Victoria Hotel, Aylmer, P.Q., but the habitat has since been destroyed. The second plant grew by the brookside near Old Chelsea and was collected Sept. 20, 1908, withered but still retaining some of the seed-filled ovaries.

Spiranthes cernua (L.) Richard. Nodding Ladies' Tresses.

This is the most fragrant of our Ladies' Tresses, growing in cold wet soils and blooming late in the autumn. It was formerly common in the old gravel-pit at Britannia, Ont., and of recent years was abundant in a swampy meadow lying between the Kingsmere hills and Simmon's Corners, P.Q. Collected Britannia Sept. 20, 1905; Kingsmere, Sept. 6, 1909.

Ranunculus aquatilis L. var. *caespitosus* D.C. White Water Crowfoot.

This dwarfed and small-flowered emersed form of the water crowfoot was common Sept. 19, 1908, spreading over the mud flats, exposed by the low water of that year, along the shore below the Country Club. The common immersed form var. *capillaceus* D.C. was also abundant in the stream.

Dentaria laciniata Muhl. Cut-leafed Toothwort or Pepper-root.

This plant, as listed in the Flora Ottawaensis, was collected in a limited area at Beechwood, Rockcliffe, near the Cemetery, and I obtained specimens there on May 13, 1906. A second locality for this species was discovered in the woods near the angle of the road which branches toward Old Chelsea as one comes cityward from Kirk's Ferry, May 26, 1906.

Cardamine parviflora L. Small-flowered Bitter-cress.

The only example observed of this little species was collected, July 4, 1909, on the rocky western summit of King's Mountain, Kingsmere.

Podostemum ceratophyllum Michx. River Weed.

The afternoon and evening of September 14, 1908, were spent by me at the Experimental Farm with Fletcher in entomological and botanical work and conversation, etc., during which he gave me directions for finding the habitat which he had discovered for the River Weed. Little did I then think that these would be the last of the innumerable pleasant and profitable hours in which I had the privilege of enjoying the genial companionship, the over-flowing hospitality and the unlimited assistance and encouragement of my gifted and lovable friend and teacher. Two days later, September 16, 1908, specimens of the plant were obtained in the Brewery Creek, Hull, almost opposite the pork factory. They were about two to four inches high but so covered with slime and dirt that it was almost impossible to make decent herbarium specimens from them. This was a year of exceptional low water in the Ottawa river, which afforded good opportunities for obtaining the littoral and aquatic plants. On September 19, while collecting along the shore near the Country Club, it was found that the rapids were so low that one could pass dry-footed, by stepping stones, to the islands. The whole channel bottom of boulders was covered with a luxuriant growth of river weed vastly different from that in Brewery Creek. Here the plants were clean and vigorous, averaging perhaps a foot in height and with terminal clusters of larger seed capsules. At this time a new concrete dam was being constructed above the Chaudiere Falls and the water was entirely diverted, leaving the river bottom exposed right to the brink of the ledge over which the torrent plunges. An opportunity was taken, November 22, to inspect the curiously split and water-worn ledges of limestone which the rushing floods of spring and the heavy ice formations of winter are always changing and wearing away. The whole river bottom, right to the brink of the chasm, was carpeted with river weed, but the plants were so dwarfed by the swift current as to be only from one to three inches in height.

Potentilla arguta Pursh. Tall Cinquefoil.

The only locality known to me for this, the largest and coarsest of our cinquefoils, is on the top of King's Mountain, where it was collected in fruit August 1, 1909, and in flower June 19, 1910.

Potentilla recta L. Rough-fruited Cinquefoil.

One specimen taken at Meech Lake, September 26, 1908, apparently an accidental seedling from some garden. A second example was found on the sloping canal bank of the Driveway, near the resident of the Papal Ablegate, May 29, 1909, which also was an evident straggler.

Potentilla tridenta Ait. Three-toothed Cinquefoil.

While examining the rocky western summits of King's Mt., on August 1, 1909, it was with much surprise and genuine delight that this lowly plant, as yet unrecorded from the district, was found established in crevices of the rocks. Though not abundant the plants immediately recalled my native shores of Cape Breton, where many dry barren slopes are profusely clothed by the stiff, dark-green foliage and starred by the innumerable small white flowers. When discovered the plants were in fruit, but flowering examples were obtained June 19, 1910.

Geum virginianum L. Rough, or Virginian Avens.

This is a coarse bristly plant with whitish flowers, a clump of which was found in the upper part of the Beaver Meadow July 9, 1908. It was also collected in a field below the Golf Club on July 11, 1908.

Trifolium arvense L. Rabbit-foot, or Stone Clover.

This dull-foliaged plant, with silky flower heads looking more like pussy-willow catkins than the honey-laden clover blossoms that brighten and perfume our fields, is listed in the Flora Ottawaensis as found in a field at Billings' Bridge, and it is stated to be rare. The only locality which I have found for it is a field of sandy gravelly soil adjoining the C.P.R. track between Aylmer and the Park, where it was abundant August 2, 1909.

Geranium Bicknellii Britton. Bicknell's Crane's-bill.

Near Skead's Mills, September 2, 1905; Britannia, June 1, 1906, flowers; top of King's Mountain, August 1, 1909, fruit.

Rhus canadensis Marsh. Fragrant Sumach.

This shrub was originally collected near Tetreaultville, P.Q., where all the individuals forming a considerable patch were thought by Dr. Ami to be parts of the same plant, having only staminate flowers and no seedlings. It also grows on the top of King's Mt., the shrubs being younger than those at Teatreaultville. Collected July 25 and August 1, 1909, and in flower May 8, 1910.

Elatine americana (Pursh.) Arn. Waterwort. Mud-purslane.

This is a diminutive plant, almost microscopical in its dimensions, which grows on the muddy margins of pools, etc. I have specimens collected by Fletcher at Brigham's Creek, Hull, in September, 1893. A good series was obtained, July 23, 1908, at Cache Bay, near Hull, on the soft mud flats laid bare by the unusually low water. The plants are firmly rooted and have to be taken up with a knife and then have the adhering mud washed off before they can be pressed.

Panax quinquefolium L. Ginseng.

In the three localities mentioned in the Flora Ottawaensis for this plant, to which the Chinese attach such an excessive medicinal value, it is now extinct. The best locality was in Powell's Grove, south of the railway track, about where Powell Avenue is now, well toward the centre of the city. The plant appears to be very rare and to occur only in the shade of rich woods. A fine specimen with its striking bunch of bright red fruit, was found in the wood north of Chelsea, September 18,

1909. During the past summer, 1916, I had the pleasure of seeing at Hudson Heights, P.Q., a quantity of ginseng, which was being grown by Mr. Girdwood, of Montreal, under the shelter of cheesecloth, and which was producing a good crop of roots and seeds.

Sanicula trifoliata Bicknell. Large-fruited Snakeroot.

Distinct by its elongate fruit and thinner foliage, making it the most pleasing of our sanicles. It was not uncommon in the rich woods beyond Chelsea, where collections were made July 1 and 22, 1906, and July 5, 1908.

Cornium maculatum L. Poison Hemlock.

This plant of ill repute grows several feet high and its delicate fern-like foliage and broad panicles of minute white flowers make it the handsomest of our umbelliferæ, or parsley family. A patch of vigorous specimens existed for some years on the roadside at Kingsmere, but has now been eradicated. There is another large patch of it about half way across the hills by what is known as the Hermit's Road. Chelsea, September 15, 1907; Kingsmere, August 5, 1908.

Cornus paniculata L'Her. Panicled Cornel.

This dogwood is of upright growth, with oblong, pointed leaves, paler beneath, and numerous cymose panicles, making a handsome ornamental shrub. On limestone ledges, margining the upper Beaver Meadow, Hull, in full flower June 29, 1906.

Pyrola asarifolia Mich. Liver-leaf Wintergreen.

In ravines of coniferous woods, Kirk's Ferry, July 9, 1905.

——— var. *incarnata* (Fisch.) Fernald. Swamp Wintergreen.

Leaves round, instead of kidney shape at base; flowers brighten pink; on mossy hummocks in swampy ground, among larches, west of Kingsmere hills; June 26, 1910; June 29, 1912.

Calystegia spithamens L. Low Bindweed.

This somewhat rare convolvulus is very different in appearance from the abundant large-flowered species which trails and climbs extensively over roadside fences and shrubberies. The leaves are oblong and, with the stems, are covered with pubescence, which gives them a greyish colour; the growth of the plant is upright, instead of trailing and it also seems to prefer dry sandy, or rocky, soils. On winter road through woods at Lake LaPeche, P.Q., July 17, 1910, and on island in Blue Sea Lake, P.Q., July 24, 1910.

Myosotis arvensis (L.) Hill. Mouse-ear. Field Scorpion-grass.

This small forget-me-not has been growing in my yard since July 1908. It apparently was introduced by debris emptied from my vasculum, although the plant had not been collected or observed by me elsewhere in the district.

Echium vulgare L. Viper's Buglos. Blueweed. Blue Devil.

When the Flora Ottawaensis was issued this plant was noted as "gradually becoming a troublesome weed." It has since spread with great rapidity in all directions, especially in dry or stony soil and well deserves its name of blue devil. Occasionally the flowers are pinkish and such plants have a more pleasing aspect.

Dracocephalum parviflorum Nutt. Dragon Head.

On gravelly shore near Aylmer Park, August 5, 1905, and in open rocky woods, top of King's Mt., larger plants August 1, 1909.

Hedeoma pulegiodes (L.) Pers. American Pennyroyal.

Fletcher recorded this plant as found in "rich wood Billings' Bridge, very rare." It was one for which I was specially on the lookout for several years without success. On June 14, 1916, while I was walking leisurely from Chelsea to Kingsmere, and about half way from Old Chelsea to the lake, a patch of bright colour, not far from the roadside, attracted my attention. On examination it was found to be *Hedeoma* growing thickly over an area of some twenty feet or so square. Nearly every summer this pleasant hillside road had been frequently traversed and a sharp lookout kept for insects, birds and plants. It seemed scarcely possible that the little mint should have been overlooked, although when not in bloom it would be inconspicuous. From the area occupied it would seem to have been colonized for some time.

Pycnanthemum virginianum (L.) Durand & Jackson. Virginian Mountain Mint.

Several specimens were found October 20, 1906,, in a dry field, between the Ottawa Golf Club, P.Q., and the river. The plants were about two and one-half feet high, with small lanceolate leaves and large-fruited corymbs.

Verbascum Blattaria L. Moth Mullein.

Dry pasture, Billings' Bridge, August 19, 1905. Slopes at north end of Fairy Lake, P.Q., July 25, 1908. Common along roadside near Buckingham, P.Q., July 1912.

Penstemon hirsutus (L.) Willd. Hairy Beard-tongue.

On talus under limestone cliff, Cache Bay, Hull, in flower, June 9, 1906. On limestone ledges, Tetreaultville, P.Q., in flower July 11, 1906. Among the rocks on top of King's Mt., fruited July 25, 1909, and common in same locality in full flower June 19, 1910.

Mimulus moschatus Dougl.

In 1908 this plant, so easily recognized by its soft, pubescent leaves, and sweet musk-scented yellow tubular flowers, was found well established in cold springy ground bordering a streamlet that crosses the road at Kingsmere and flows down toward the Gatineau through a wooded ravine. Occasional specimens occurred along the stream for about a mile. As to this plant being indigenous, or introduced, in the East is uncertain and at Kingsmere it may have become established by garden escapes or seeds carried down by the brooklet, which flows by a couple of farms. The species is native to British Columbia, and Macoun in his Catalogue of Canadian Plants, vol. 1, p. 358, says of it: "Certainly a garden escape in N.B." Britton & Brown, in recording eastern occurrences give them as "Adventive from the Pacific Coast." Gray's Manual gives it as found in "Damp soil, especially by cold streams, Newfoundland to Michigan; abundant in the Rocky Mountains, whence perhaps introduced." The Kingsmere plants were still growing and blooming last summer, although they had been much destroyed by the trampling of cattle around the water. Specimens collected September 20, 1908, and July 4, 1909 .

Gratiola aurea Muhl. Golden Hedge Hyssop.

Rather abundant on muddy shore, among rocks, on point in Ottawa river, near Deschenes, P.Q., August 26, 1905. On river shore, Hull, near C.P.R. bridge, August, 1908.

Veronica arvensis L. Corn Speedwell.

Specimens from Fletcher are labelled "Roadside, Gilmour's Grove, Chelsea, P.Q., June 8, 1901." Mine were collected on dry rocky ground about half-way between Fairy Lake and Hull, June 6, 1909.

Lonicera caerulea L. var. *villosa* (Michx.) T. & G. Mountain Fly Honeysuckle.

In spruce woods bordering the peat swamp, Mere Bleue, Carlsbad Springs, Ont., on July 18, 1905, with ripe fruit. A shrubby plant with lightly pubescent twigs; leaves oblong and thickish; twin fruits coalescent into one large blue berry, stated in Gray's Manual to be edible.

Lonicera oblongifolia (Goldie.) Hook. Swamp Fly Honeysuckle.

Recorded in Flora Ottawaensis from "Peat Bog, Mere Blue. Rare." It grew, however, nearer home, as I found it in fruit in Dow's Swamp on June 24, 1905. The leaves are broadly oval or oblong with a bluish tint; fruit small, purplish, coalescent or semi-coalescent.

Triosteum perfoliatum L. Feverwort. Horse Gentian. Tinker's Weed.

My search for this plant was void until it was found in fruit on October 3, 1909, at Kingsmere. Flowering examples were taken June 19, 1910, in the same locality. The plant is of coarse growth, with much of the appearance of a milkweed. The flowers and fruits are situate at the axils of the leaves, and this, combined with the stout stems, makes it difficult to produce good herbarium specimens.

Viburnum pubescens (Ait.) Pursh. Downy Arrow-wood.

Rocky open woods, top of King's Mt., in fruit July 25, 1909.

Lobelia spicata Lam. Pale Spiked Lobelia.

Several examples found growing in hay-field in Beaver Meadow, Hull, July 14, 1905, and a few in a hayfield near the railway station at Chelsea, July 5, 1908. Extinct in both habitats through subsequent cultivation.

Lobellia Dortmanna L. Water Lobelia.

Taken by Fletcher in Mud Bay, Meech Lake, but searched for there unsuccessfully for several years, failure to find the plant being probably due to its not being in flower and still below the surface of the water. On August 7, 1912, I found this plant growing profusely, in full flower, in water two to three feet deep with gravelly bottom, in the Forks Lake, a few miles from Sydney, N.S.

Eupatorium perfoliatum L. Thoroughwort. Boneset.

Examples of this common boneset were found August 7, 1905, growing along a ditch at Kirk's Ferry, with whorls of three connate perfoliate leaves in place of the usual two opposite ones. The extra leaf adds much to the symmetry and beauty of the specimens. Other examples of the same triperfoliate form have since been observed on several occasions in swampy ground nearer Chelsea.

Solidago latifolia L. Zigzag, or Broad-leafed Goldenrod.

This species appears to be rare and has been found only in a wet cedar wood near Hull, between the Aylmer road and the river, September 16 and 28, 1905. The broad sharply saw-toothed leaves and the racemose spikelets of flowers arising from the leaf axils of several terminal inches of the stem make this a handsome goldenrod.

Antennaria fallax Greene. Everlasting. Pussy's Toes.

This species is not given in the Flora Ottawaensis or in Macoun's Catalogue of Canadian Plants, but I have a specimen collected by Fletcher at Rockcliffe, June 11, 1904. It seems to be well established on the top of King's Mt., near the signal station. Possibly this is the species recorded as *plantaginifolia* in the Flora Ottawaensis.

Helianthus divaricatus L. Rough, or Woodland Sunflower.

Under the record of *H. annuus,* as an escape from cultivation, Fletcher says, "It is rather remarkable that we have so far found none of the native Helianthi wild in this locality." This absence was often discussed by us because we had received, in

1885, from Mr. Wm. Bowles, of Montreal, numerous examples of a tortoise-bettle, *Physonota unipunctata* Say, which he had taken feeding on such plants. We were anxious to ascertain whether the beetles occurred here, but never during Fletcher's lifetime could find any sunflowers. The next summer, while exploring the summits of King's Mt., August 1, 1909, not far from the signal station, I was greatly surprised, as well as delighted, to find in full bloom many of these conspicuous flowers which were scattered over the western rocky front of the mountain. They have been abundant each season, but so far the beetles have not appeared It is strange that we should so often have visited the mountain and that, at such a short distance away, these long-sought flowers must have been blooming unseen. The species had evidently been established many years earlier and I find that Macoun in his Catalogue of Canadian Plants records it as found by Billings at Chelsea, and that the McGill Coll. Herb. contains examples from the vicinity of Ottawa.

Bidens Beckii Torr. Water Marigold.

This is an aquatic form of beggar-ticks, which the Flora Ottawaensis gives as "Not uncommon in the Ottawa and Rideau rivers, but seldom flowering." In the canal, not far from Hartwell's Locks, flowers were abundant September 7, 1908.

Chrysanthemum Parthenium (L.) Bernh. Feverfew.

This is evidently a garden escape which became established along the roadside at Kingsmere, but it is of interest in connection with the occurrence of the musk flower previously mentioned, as it was found July 4, 1909, at some distance down the ravine through which the brooklet flows. Growing in the shade of the trees and in wetter soil the plants were taller, more spindly, and with thinner foliage.

Petasites palmatus (Ait.) Gray. Sweet Coltsfoot.

I can remember when this plant grew in the swampy enclosure of the old race-track at Powell's Grove, on the Glebe property, and May 1, 1906, Fletcher gave to me flowers grown at the Experimental Farm from plants gathered years before in the locality mentioned. My friend Mr. Frank Latchford (now a Judge) subsequently informed me that he had found the plant growing in a swamp near Simmon's Corners, P.Q., but I could not find the location until June 29, 1912. Leaves only were obtained then and I have not since visited the swamp early enough to collect flowers.

HORNED LARKS AT AWEME, MANITOBA.

By STUART AND NORMAN CRIDDLE.

There are few small birds better known than the Horned Larks when considered collectively, that is to say, when we merely recognize them as a species without attempting to divide and distinguish them as they have been separated by systematists. We are, for instance, all familiar with the Prairie Horned Lark, or think we are, until its close allies are placed alongside, when few indeed will be able to tell one from another. The fact that these birds have been divided into so many geographical races which are so alike in general appearance, makes them of particular interest to students of geopraphical distribution. The systematists have divided them and given them names. It remains for the workers in ecology to confirm or reject this classification by showing that there is, or is not, a difference in life habits. We doubt very much, whether two distinct races will ever possess identical habits and we hold that if these habits differ ever so little, then there is every reason to believe that the animals possessing them are distinct. A difference of a few days in the average date of arrival, the selection of a different situation or kind of locality for breeding purposes should be alone sufficient to demonstrate that there are two races involved. We have a case in point in the local Lapland Longspur migrations. With these birds there are two very marked differences, both as to time of arrival and departure. We have never actually demonstrated by collecting specimens, that there are two races involved, yet there can be little doubt that such is the case. Turning to our Manitoba Horned Larks, we have long realized that there were three or four races present, though it is only within recent times that the senior writer has actually shown this to be so by the collecting of examples. These specimens have been determined through the courtesy of Dr. Henshaw, by Mr. Oberholser of the U. S. Biological Survey, to both of whom the writers are under many obligations.

We have, so far, been able to recognize four horned larks in the vicinity of Aweme, Manitoba, namely: the Prairie Horned Lark, *Otocoris alpestris practicola;* Oberholser's Horned Lark, *O. a. enthymia*, the Pallid Horned Lark, *O. a. arctica,* and the Hoyt Horned Lark, *O. a. hoyti.* Of these the first two are summer residents in the neighbourhood, while the latter have only been noted as migrants.

PRAIRIE HORNED LARK.

This is the dominant race around the farm yard and seems to take more kindly to the haunts of man than do its allies. In nature it is found breeding in the vicinity of semi-wooded areas; uplands where the grass is sparse and the soil sandy seem to suit it best. It is far less of a true prairie bird than *enthymia* and while it invariably selects open ground for nesting purposes, it is not uncommon to find such nests situated within a few feet of low trees or bushes upon which the males sometimes perch while singing.

The Prairie Horned Lark is the first of all migrants to return from the south and in consequence its arrival is heralded as the first harbinger of spring, a forerunner of the glories to come when animated nature awakens once more from its long winter's sleep. Even Manitobans admit that the winters, while invigorating, are, at times, a trifle long, hence the reappearance of the horned larks is a welcome one. They frequently return to us while the country is still under a mantle of snow but we feel, nevertheless, that their northward movements are impelled by Old Sol's persuasion and that it will not be long before this is demonstrated.

From an examination of records covering 20 years, we find that the first spring arrival reaches us, on an average, about February 22. At times they have been seen much earlier, at others, later. In autumn, the last to leave averages November 16. There are winters when odd individuals may be seen throughout the season, but these are exceptions.

The male horned larks, like so many other birds, arrive well ahead of the females, and until the latter appear remain comparatively quiet, contenting themselves with the daily search for food and with uttering, from time to time, that cheery little song with which we are all familiar. In a little more than two weeks the females appear, altering in a moment the peaceful existence of their mates to be. Individual combats are now of frequent occurrence and continue until both mates and nesting sites have been won. The males now exercise all their powers of song, rising high in the air during the day and at twilight making the whole countryside resound with their characteristic songs. In these efforts they continue as long as there is light and commence again in the morning at the first indication of dawn. To us there are few more cheerful songsters and as they frequently choose a singing perch within a few feet of the house we have every opportunity to judge of their merits.

Nests are invariably sunk into the ground so that their upper edge is little above its surface. At times some beautiful clump of anemonies may hide the young from view, at others there is practically no shelter, the birds apparently depending wholly upon their dull colours to hide them from their enemies. We have found nests with eggs in them about the middle of March and young birds able to fly on April 14. How they manage to survive the snow storms and cold, not uncommon at this time of year, is a mystery. That they do so there is no doubt. As a rule, however, the percentage of young reared in the early season is low and in the first brood one seldom meets with more than a single fully developed nestling, though in later broods three or four are often reared. We find that the average number of broods is three, though at times there may be a fourth. In their domestic duties both birds take an active part, the male not only relieving the female upon the nest but also taking his share in feeding the young. In fact they are an excellent example of true domestic harmony, in as much as each contribute an equal share to the family welfare.

In 1916, a nest of this species was located in a garden among some old dead flowers. It suffered somewhat by being raked over before it was noticed, but was replaced with sufficient care to satisfy the old birds. They were an unusually tame couple and were thus able to be watched without disturbing their daily habits. It was seen that both were equally energetic in tending the young though the male was less frequently found upon the nest, while during the early morning and again in the evening, his musical tendencies overcame his usual domestic thoughts, or perhaps, as seems more likely, the young required less attention at such times, so he devoted his energy to a serenade for the benefit of his domestic little mate. Food for the young was secured close at hand and consisted of a mixed up mass of insect matter, as a rule unidentifiable. From this mass, however, numerous cutworms were seen hanging, from time to time, the identity of which was unmistakable. The female was particularly fearless and would continue her domestic duties while we watched from a few feet away. Thus we often saw her feed the young and likewise fit her body snugly over them afterwards. On June 27 one young bird had left the nest and was followed next day by the remaining one. Neither could fly at this time and both were frequently seen close at hand afterwards.

These birds remain for a considerable time around their homes after nesting and seldom, if ever, gather into flocks or congregate upon the ploughed fields as do other kinds of horned larks.

OBERHOLSER'S HORNED LARK.

We are less familiar with this bird than with the last and owing to the difficulty of determination, it was longer before we were able to distinguish it in the field. As was to be expected, birds so closely related as the horned larks have much in common concerning habits of living, though it is astonishing how many differences there are when they are studied closely. We shall not attempt to present the habits of this race in detail, as in a general way they resemble those of *praticola*, but will content ourselves by comparing the chief points of difference.

To begin with, *enthymia* is practically a month later in arriving from the south. Then, instead of arriving as odd individuals, as does the Prairie Horned Lark, it comes in flocks varying from seven to twenty or more, and at the height of the migration in bunches of several hundred. Thus they are soon found in large gatherings upon ploughed fields, where they remain for about a month before dispersing for their nesting grounds. It is, therefore, May before they commence domestic duties, our earliest record for a nest with fresh eggs being May 3. In selecting their breeding grounds these birds show a preference for the larger plains which are well away from trees of any kind. They also nest in colonies like the Chestnut-colored Longspur, in fact the summer homes of these two birds are very similar. The nests of *enthymia* do not differ in any marked degree from those of *praticola,* but they are usually in rather denser vegetation.

Colonies of Oberholser's Horned Larks have been known to us for a number of years situated on a small plain north-west of our home. Another lot of almost a hundred have recently taken up their quarters on some deserted fields which they have occupied for the last two years.

The fact that this race is gregarious seems to account for the individuals being less pugnacious than the Prairie Horned Lark, and perhaps, also, for their being less musical. Our observations indicate that they rise less high in the air while singing and that their song is softer and the notes less distinct. On account of their lateness in commencing to nest it does not seem probable that there are more than two broods in a season. Nor do the birds remain as long upon their breeding grounds, but as soon as the nesting season is over they return to the ploughed fields, where they are joined later on by other kinds and so become hopelessly mixed from a naturalist's point of view.

Thus it will be seen that while these two breeding races are extremely difficult to tell apart, their habits are such as to leave no doubt as to their distinctness.

THE PALLID HORNED LARK AND THE HOYT HORNED LARK.

Of the Pallid Horned Lark—*articola*—and Hoyt Horned Lark—*hoyti*—we have little to write. They are, so far as we know, both migrants only, and pass to other parts for nesting purposes. They usually arrive within a few days of each other and with the Lapland Longspurs in large flocks about April 6. Soon the ploughed fields are swarming with them and their value as destroyers of noxious weed seeds must be considerable. At this time they are somewhat secretive. They nearly always run in a crouching attitude and squat down flat at the least alarm, when their colour resemblance to the surrounding landscape makes them almost invisible from a short distance away. The squatting action also prepares them for a spring upwards and as one rises, in alarm, the others quickly follow, so that in a moment thousands of birds are in the air rapidly darting up and down. Then suddenly they drop onto the field again and all is quiet as before.

It is an interesting sight to see these birds, in company with thousands of Longspurs, circling for miles around some large hawk, though their object in doing so is a mystery and seems to be almost ignored by the hawk. Their music, as they fly around in millions, fills the air, producing an effect which is long remembered. Both Horned Larks and Lapland Longspurs may also be seen to rise some 30 feet, uttering as they drop a short song. It is evident, however, that this is only a prelude to what is to come when the birds reach their true homes.

NOTES.

Over seven hundred fragments of pipes made of pottery have been counted among the finds made in the prehistoric Iroquoian Indian site at Roebuck, Ontario, by Mr. W. J. Wintemberg, who explored there for the Geological Survey in 1912. Wagon loads of pottery and some charred corn and beans, but only four arrowheads chipped out of stone, being found here among other finds, suggest that the prehistoric inhabitants were apparently agriculturists who did not hunt and fight as much as we are generally led to believe that the Indians did. Over eighty graves were found, but only one contained anything besides the skeleton, the custom apparently being different from that among many other kinds of Indians.

An aged Maya Indian woman from near Progresso, Yucatan, is residing in Ottawa, undoubtedly the only person in the Dominion who can speak Maya. The Mayas are the remnants of the tribe that is believed to have built the most beautiful of the ruined cities of Mexico and Central America—the finest architecture of the New World.

Oyster and quahog shells were found by Mr. W. J. Wintemberg in exploring a shellheap on Mahone Bay, N.S., for the Geological Survey of Canada. The oyster and quahog have not been known to live on the southeastern or outside coast of Nova Scotia since the region was first visited by white people. The finding of these shells consequently suggests that the heaps are of considerable antiquity and is of interest to the students concerned with these shell fish as indicating that at least these two species formerly lived in the waters near Mahone Bay. While the Indians may have carried dried oysters and clams for some distance, it is hardly likely that they transported them in the shells or that they carried the shells from a distant place, especially since we do not find these particular shells were used by the Indians in this vicinity. In fact the Indians who left the shellheaps of the eastern coast of Canada did not use shell to any very great extent.

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NOTES ON THE BOTTOM ENVIRONMENT OF THE MARINE INVERTEBRATES OF WESTERN NOVA SCOTIA.[1]

By E M. Kindle.

During the summer of 1914, a study of the relationship of the bottom materials to the composition of the faunas living upon them in the shallow coastal waters of western Nova Scotia was undertaken by the writer assisted by Mr. E. J. Whittaker. At the time the report [a] on this work was written only the pelecypods and gasteropods collected during the progress of this work had been determined. The remainder of the fauna which was referred to Dr. Paul Bartsch of the U.S. Nat. Mus. for identification has since been studied by Dr. Bartsch and other specialists. The resulting list of species includes at least one species,—*Libinia emarginata* Leach,—not previously known in Nova Scotian waters. The following list which I am able to prepare through the courtesy of Dr. Bartsch is offered as a minor contribution to our knowledge of the bathymetric range and the bottom environment of the several species which were collected. For the sake of completeness the present list is made to include the pelecypoda and gasteropoda which were listed in the writer's earlier paper.[b]

The character of the bottom at each collection station is indicated in the following list of stations.

Collecting Stations.

Sta. No. 1. Digby, N.S., Intertidal zone, boulder strewn beach.
2. Digby, N.S., 300 to 400 yards east of Government pier in 2 fathoms. Soft black mud bottom.
3. Digby, N.S., 3 to 4 miles N.E. of Digby, Outer margin and inside of bar running S.W. from Bear Island; in 3 to 6 fathoms. Collection nearly all from muddy sand.

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[1] Published with the permission of the Director of the Geological Survey of Canada.

[a] E. M. Kindle, Bottom control of Marine faunas as illustrated by dredging in the Bay of Fundy. Am. Jour. Sci. vol. XLI, 1916, pp. 449-461.

[b] Ibid.

4. Bear Island, N.E. of Digby, N.S. 4 miles. Intertidal zone, boulder strewn beach.
5. Head of St. Mary's Bay, N.S., Intertidal zone. Beach of sand, gravel and mud.
6. Kingsport, N.S. 1½ miles N.E. of pier. Gravel bottom, shallow water.
7. Kingsport, N.S. Channel opposite Kingsport pier; 1 fathom at low tide; sandy mud bottom.
8. Kingsport, N.S. Intertidal zone. Beach of rocks, gravel and muddy sand (Living shells in pools).
9. Kingsport, N.S. Beach of sand and mud between tides (Dead shells).
10. Mouth of Avon River opposite Chiverie Pt. N.S. 2 to 6 fathoms, rocky and sandy bottom.

The term intertidal zone is used here instead of littoral zone which was formerly in universal use for the zone between low and high tide, because the latter term has in recent years been used by Dall, Grabau and some others to include the marine habitat down to depths of 100 fathoms.

FAUNAL LIST.	Boulders and sand. Intertidal zone.	Black mud.	Sandy mud.	Boulders & gravel. Intertidal zone.	Sand, gravel & mud. Intertidal zone.	Gravel.	Sandy mud.	Gravel and rock. Intertidal zone.	Mud and sand. Intertidal zone.	Rocky and sandy bottom.
	1	2	3	4	5	6	7	8	9	10
PORIFERA.										
Desmacidion palmata Johnston	---	---	- -	- -	- -	- -	x	- -	- -	x
COELENTERATA.										
Hydractinia echinata (Fleming)	---	---	x	- -	- -	- -	- -	- -	- -	- -
Monocaulus glacialis (Sars)	---	---	x	- -	- -	- -	- -	- -	- -	- -
VERMES.										
Harmothoe imbricata (Linn) Mob., 3 specimens	---	x	x	- -	- -	- -	- -	- -	- -	- -
Lepidonotus squamatus (Linn) Kinberg, 1 specimen	---	---	- -	- -	- -	x	- -	- -	- -	- -
Nephthys caeca (Fabr.) Oersted	---	---	x	- -	- -	- -	- -	- -	- -	- -
Phascolion strombi Montagu, 2 specimens	---	---	x	- -	- -	- -	- -	- -	- -	- -
Sternaspis fossor Stimpson, 1 specimen	---	x	- -	- -	- -	- -	- -	- -	- -	- -

FAUNAL LIST	Boulders and sand. Intertidal zone. 1	Black mud. 2	Sandy mud. 3	Boulders & gravel. Intertidal zone. 4	Sand, gravel & mud. Intertidal zone. 5	Gravel. 6	Sandy mud. 7	Gravel and rock. Intertidal zone. 8	Mud and sand. Intertidal zone. 9	Rocky and sandy bottom. 10
MOLLUSCOIDEA.										
Alcyonidium mytili Dalyell	—	—	x	—	—	—	—	—	—	—
Cribrilina punctata (Haasall)	—	—	—	—	—	x	—	—	—	x
Membranipora monostachys (Busk.)	—	—	—	—	—	x	—	—	—	x
Membranipora flemingii (Busk)	—	—	—	—	—	x	—	—	—	x
Mucronella peachii (Johnston)	—	—	—	—	—	x	—	—	—	x
Schizoporella biaperta (Michlin)	—	—	—	—	—	x	—	—	—	—
PELECYPODA.										
Anomia simplex Orb.	—	—	—	—	—	—	—	—	—	x
Astarte crenata Gray	—	—	—	—	—	x	—	—	—	x
Astarte undata Gld.	—	—	x	—	—	x	—	—	x	x
Callocardia morrhuana Linsley	—	—	—	—	—	x	x	—	x	—
Cardium pinnulatum Conr.	—	x	x	—	—	—	—	—	—	—
Clidiophora gouldiana Dall	—	—	x	—	—	x	—	—	—	—
Cyprina islandica L.	—	—	x	—	—	—	—	—	—	—
Cytherea convexa Say—(Callocardia morrhuana Linsley)	—	—	—	—	x	—	—	—	—	—
Ensis americana Gould	—	—	—	—	x	—	x	—	x	—
Epitonium groenlandicum Perry	—	—	x	—	—	—	—	—	—	—
Lyonsia hyalina Conr.	—	x	—	—	—	—	—	—	—	—
Macoma balthica L.	—	—	—	—	—	—	x	—	x	x
Macoma balthica fusca Say	—	—	—	—	x	—	—	—	—	—
Macoma calcarea Gm.	—	—	x	—	—	—	—	—	—	—
Macoma sp.	—	—	x	—	—	—	—	—	—	—
Mactra solidissima Dillwyn (Spisula solidissima)	—	—	—	—	—	—	—	—	x	—
Modiolaria discors L.	—	—	—	—	—	—	—	—	—	x
Modiolaria nigra Gray	—	—	—	—	—	—	—	—	x	—
Modiolus fragm.	—	—	—	—	—	x	—	—	—	—
Modiolus modiolus L.	—	—	—	—	x	x	—	—	x	x
Modiolus plicatula Lam. (M. demissus Dillw.)	—	—	—	—	x	—	—	—	—	—
Mya arenaria L.	x	—	—	x	x	x	x	x	x	x
Mytilus edulis L.	x	—	—	—	x	x	—	x	x	x

FAUNAL LIST	Boulders and sand. Intertidal zone. 1	Black mud. 2	Sandy mud. 3	Boulders & gravel. Intertidal zone. 4	Sand, gravel & mud. Intertidal zone. 5	Gravel. 6	Sandy mud. 7	Gravel and rock. Intertidal zone. 8	Mud and sand. Intertidal zone. 9	Rocky and sandy bottom. 10
Nucula proxima Say	---	x	x	- -	- -	- -	- -	- -	- -	- -
Pecten magellanicus Gm.	---	---	- -	- -	- -	x	- -	- -	- -	- -
Periploma fragilus Totten	---	---	x	- -	- -	- -	- -	- -	- -	- -
Petricola pholadiformis Lam.	---	---	- -	- -	- -	x	x	- -	x	x
Saxicava arctica L. (S. rugosa)	---	---	x	- -	- -	- -	- -	- -	- -	- -
Thyasira obesa Ver.	---	x	x	- -	- -	- -	- -	- -	- -	- -
Venericardia borealis Conr.	---	---	- -	- -	- -	x	- -	- -	x	- -
Yoldia limatula Say	---	x	x	- -	- -	- -	- -	- -	- -	- -
GASTROPODA.										
Acmaea testudinalis L.	x	---	- -	x	- -	- -	- -	- -	- -	- -
Aporrhais occidentalis Beck.	---	---	x	- -	- -	- -	- -	- -	- -	- -
Bela nobilis Moll	---	---	x	- -	- -	- -	- -	- -	- -	- -
Buccinum undatum L.	x	---	x	x	- -	x	- -	x	- -	x
Chrysodomus decemcostatus Say	---	---	x	- -	- -	- -	- -	- -	- -	- -
Crepidula fornicata L.	---	---	- -	- -	- -	x	- -	x	x	x
Crepidula plana Say	---	---	- -	- -	- -	x	- -	x	x	x
Crucibulum striatum Say	---	---	- -	- -	- -	x	- -	- -	- -	- -
Cylichna alba Brown	---	x	x	- -	- -	- -	- -	- -	- -	- -
Ilyanassa obsoleta Say	---	---	- -	- -	x	x	x	x	x	x
Lacuna vincta Turton	---	x	x	- -	- -	- -	- -	- -	- -	- -
Littorina litorea L.	x	x	x	x	x	x	x	x	x	x
Littorina palliata Say	x	---	- -	- -	x	- -	- -	- -	x	- -
Lunatia heros Say	---	x	x	- -	x	- -	- -	x	- -	x
Lunatia triseriata Say	x	---	x	- -	x	- -	- -	x	- -	- -
Melampus lineatus Say	---	---	- -	- -	x	- -	- -	- -	- -	- -
Thais lapillus L.	x	---	x	- -	x	x	- -	x	x	x
Tritonofusus stimpsoni lirulatus Verr.	---	---	x	- -	- -	- -	- -	- -	- -	- -
Tritia trivittata Say	x	x	x	- -	x	x	- -	- -	x	x
Urosalpinx cinereus Say	---	---	- -	- -	- -	- -	- -	- -	- -	x
ECHINODERMATA.										
Asterias vulgaris Stimpson 15 specimens	---	---	- -	- -	- -	x	- -	- -	- -	- -
Echinarachnius parma (Lamarck) 6 specimens	---	---	x	- -	- -	- -	- -	- -	- -	- -

FAUNAL LIST	Boulders and sand. Intertidal zone. 1	Black mud. 2	Sandy mud. 3	Boulders & gravel. Intertidal zone. 4	Sand, gravel & mud. Intertidal zone. 5	Gravel. 6	Sandy mud. 7	Gravel and rock. Intertidal zone. 8	Mud and sand. Intertidal zone. 9	Rocky and sandy bottom. 10
Henricia sanguinolenta (O. F. Muller) 12 speciments						x				
Strongylocentrotus drobachiensis (O. F. Muller) 1 specimen			x							
CRUSTACEA.										
Cancer irroratus Say		x	x			x				x
Hyas coarctatus Leach										x
Leptocheirus pinguis (Stimpson)			x							
Libinia emarginata Leach (new to N. S.) 1 specimen										x
Pagurus acadianus Benedict 41 specimens		x	x							
Pagurus longicarpus Say, 6 specimens shells encrusted with Hydractinia echinata (Fleming)						x				x
Pagurus pubescens Kroyer 2 specimens			x							
CHORDATA.										
Boltenia ovifera (L) 1 specimen Bay of Fundy; collected by fishermen in deep water off Digby										

BOTTOM ENVIRONMENT.

Analysis of the data given in the preceding table will show that different types of sea bottom are occupied by assemblages of animals which are almost as sharply contrasted in composition as are the land faunas of deserts and swamps. On land some plants can live only on wet marshy ground; other groups require dry uplands, and some flourish only on rocky slopes; while over great areas which support a rich flora trees cannot exist. The groupings of land animals is controlled in the same way directly by the character of the soil and indirectly by the plant life which itself is almost wholly influenced by surface physical features. Thus the frog, salamander and turtle which dominate the animal life of the marshes give way entirely to other types on the uplands.

The influence of this familiar and powerful factor,—the character of the soil or rock,—in determining the major features of land biotas, is paralleled by the control which the physical character of the bottom exercises over marine biotas. When marine dredging is conducted with the object of ascertaining the relationship of the various kinds of bottom to the kinds of life living on them, as most of the writer's have been, the association of certain faunal with certain bottom facies becomes clearly apparent. The control exercised by the physical character of the bottom in bringing together certain groups of animals and plants into marine communities and in excluding others is just as effective as is the operation of the physical character of the land surface in producing varied faunal and floral groups.

The distribution of the sponges is one of the interesting features brought out in collecting the fauna listed above. These were found in such abundance on the coarse rocky bottom at the mouth of the Avon river and on the hard muddy sand bottom off Kingsport as to completely fill the dredge in some hauls. On soft mud bottom however, not a single sponge was taken. The molluscoidea also show a strong affinity for hard bottom, five species being taken on gravel and rocky bottom, one on firm muddy sand bottom, and not a single species on soft bottom. The four species of echinoderms taken were all found either on gravel or the comparatively firm sandy mud bottom. The preference of the crustacea for hard or firm bottom is also evident. The seven species listed were all taken either on gravel, rocky, or sandy mud bottom, and but two of them on soft bottom Only two specimens of *P. acadianus* were taken on soft mud bottom and 39 specimens were taken on the sandy mud bottom.

The fauna of the soft mud bottom shown by the list includes thirteen species which are confined to the four groups, vermes, pelecypods, and gasteropods and crustacea. Two of the species were not found outside the limits of the soft mud. The specialized character of the black mud fauna is apparent from the fact that it contains no representatives of the *Porifera, Molluscoidea* nor *Echinodermata* The mud bottom in developing its soft bottom facies draws from but four of the eight phyla which are abundantly represented in the region.

When you are in or near the forest this summer, never leave your camp fire until it is absolutely OUT. Never throw away lighted matches or tobacco or pipe ashes. These rules are followed by all veteran sportsmen and good citizens.

MY BIRD HOUSES.

By CLYDE L. PATCH.

As it will soon be time to construct bird houses, which should be in place a couple of weeks before the feathered tenants arrive, thus giving the newness time to wear off, an account of my last summer's experience may assist and encourage other members of the O. F. N. Club.

Until last spring I had supposed that a martin house was usually in place two or three years before the birds discovered it, or at any rate would nest in it; also, that the person owning the house was particularly lucky, and thirdly that the house must be situated in a large open yard.

Having been requested to furnish bird house plans for manual training work, I built an experimental martin house, with twelve compartments measuring 6 in. x 6 in. x 6 in., each having an entrance 2 in. in diameter the bottom edge of which is 2 in. above the floor. Across the outside of the house and 2 in. below the entrance holes is a 3 in. platform, which forms a landing stage for the parent birds and a play ground for the young when they first venture out.

So, having constructed the house I, one evening, with the assistance of a neighbor, erected it on a twenty foot pole in my sixteen by twenty back yard in the Glebe, (Ottawa) expressing the hope that if the wind didn't blow it down I might get tenants by 1920. Three days later Mrs. Patch informed me that house seekers had been about during the morning, and upon looking out I saw a pair of those beautiful opals of the air, commonly called tree swallows, exploring my apartment house. A few days later they began carrying sticks and straws from all over the neighborhood and alighting promiscuously on the landing platform running under the three top holes, followed their noses straight into the nearest hole, thus building three nests. Seeing that this would never lead to a happy family, I constructed a box 6 in. x 6 in. x 15 in. deep with a landing platform under the 1½ in. entrance hole and the overhanging eave of the sloping roof above it. A day or so after placing this house on a near-by fifteen foot pole, the swallows examined it and after driving off another pair of persistent house-seekers, they abandoned the three nests in the martin house and began house furnishing in the new home. Following a few days of busy stick carrying the feather lining was added, and thereafter for the next two weeks Lady Swallow was seen only a short time each day when she trusted the four transparent and later delicate rose-coloured eggs to the care of Mr.Swallow and fed in the immediate neighborhood.

Then one day to my great delight a martin lit on the martin house, remaining a short time and returning next day with a mate. This pair shortly began nest building in one of the apartments under the eave of the roof. Before the nest was completed another pair had taken an apartment under the eave on the opposite side of the house, which convinces me that eaves are desirable, therefore I intend to put hoods or some sort of protection above all the entrance holes.

Before the martin nests were complete a pair of wrens put in an appearance, clinging to the martin house hole and at every opportunity alighting on the house and peering in. The martins were very much annoyed and made ferocious swoops at the wrens, who darted, almost faster than the human eye could follow, behind the board fence.

I immediately built a box 5 in. x 5 in. x 12 in. deep with an entrance slightly larger than a silver quarter, under the entrance a landing platform and above it the overhanging eave of the sloping roof. This box was placed on a pole about five feet below the martin house. In half an hour the wrens were happily singing as they built their nest.

I wonder if all wrens are as intelligent as mine! A twig four or five inches long was frequently brought to the platform and one end shoved through the entrance hole, then the wren passed in drawing the twig with him. The martins, with the same length twig grasped in the centre, would attempt to pass straight through their two-inch entrance hole. If after several strenuous efforts the twig or straw did not break or bend it was dropped to the ground. Consequently the martins' nests were made chiefly of short or bendable material, while the wrens' nest were of surprisingly heavy twigs.

The swallows kept to their own premises, but not infrequently the curiosity of one of the martins—probably a female—necessitated a visit to the swallow home, where alighting on the front porch and putting her head through the entrance she was apparently given a peck in the face, as her head would be quickly withdrawn in time to see father swallow swooping down from a nearby telephone wire. Then both birds would rise in the air and for half a minute or so face each other apparently sitting on their tails and, with fluttering wings, say unprintable things; then the martin would fly home and the swallow back to his wire.

When the babies arrived the parent swallows were constantly busy capturing flying insects, while the parent wrens hunted the flower beds and bushes for hairless caterpillars.

The tree swallows were quiet birds and at no time did I see the young, although I frequently heard them in their nest box. Evidently they do not return to their nesting site after once leaving it. The martins were quite different, adhering to the old saying "the more the merrier," as the frequent appearance of visitors from Wellington Street eaves or bird houses in Ottawa South was the signal for a great chattering, melodious martin calls and circling in the air, and the entrance to their home was nearly always filled with expectant baby mouths and later the youngsters ventured out onto the platform and when able to fly they, for two or three weeks, returned every night; then their visits became less frequent until one day, accompanied by some friends, there being twenty-three birds in all, they bade the old homestead a noisy farewell.

The young wrens remained in the neighborhood a week or so and the adults were often heard singing until late fall.

My two male martins had the white and gray plumage similar to that of the female. This spring I hope to see them in their black-purple-sheened plumage which is probably acquired in their second year.

BIRDS OBSERVED AT GRANDE PRAIRIE CITY, PEACE RIVER DISTRICT.

By FRANK L. FARLEY, CAMROSE, ALTA.

I spent four days from June 30 to July 3, 1916, in and around Grande Prairie City, and noted the birds mentioned below. This town is the centre of the far famed district of the same name, and is about sixty miles due south of the old post, Dunveagan, on the Peace River and is, roughly, 250 miles northwest of Edmonton. The town is only a year or so old, and is now as large as some of the towns in the older settled portions of the Province. It is situate on Bear Creek, a small stream which flows into the Wapita, a few miles to the south. The country is mostly prairie, with scattered bluffs of poplar and willow, and rolls slightly. The grasses and shrubs are very similar to those around Edmonton. To the east of this prairie country the railway passes through one hundred miles of large poplar, some of which is twenty inches in diameter. This is surely the great summer home of the White-throated Sparrow and the Junco. There were more White-throats noticed than all other birds combined. I counted a dozen singing in the valley of the Smoky River, all within three hundred yards of the train. They were particularly very plentiful throughout this territory. On the prairie, the Vesper Sparrow was by far the most abundant bird. I was surprised to find the English Sparrow quite at home in the town, there being at least a hundred feeding around the elevators and warehouses. They of course, used their regular way of travel—the freight car. The list is given in the order that the birds were observed.

Junco; very common.

White-throated Sparrow; very common.

Clay-colored Sparrow; fairly common.

Crow; 50 seen.
Red-eyed Vireo; common.
Yellow Warbler; common.
Wood Pewee; 10 heard.
English Sparrow; 100 seen.
Lincolns Sparrow; fairly common.
Robin; 25 seen.
Yellow-shafted Flicker; common.
Least Flycatcher; common.
Savanna Sparrow; common.
Red-winged Blackbird; a few seen.
Leconte Sparrow; not common.
Tree Swallow; fairly common.
Spotted Sandpiper; few seen on creek.
Mallard; one pair seen.
Vesper Sparrow; very common on prairie.
House Wren; fairly common.
Fox Sparrow; about 25 heard.
Brewers Blackbird; a few seen.
Trail's Flycatcher; not common.
Warbling Vireo; common.
Wilson's Thrush; a few heard in bluffs.
Night Hawk; one heard.
Cliff Swallow; common, nesting on the cliffs.
Bank Swallow; common.
Cow Bird; not common.
Pewee; a few seen.
Tennessee Warbler; heard several.
Golden-eyed Duck; one seen.
Red Start; one heard.
Sparrow Hawk; not common.
Song Sparrow; rare.

ARE OUR FORESTS VANISHING?*

Belgium, the most intensively cultivated country of Europe, with 652 inhabitants to the square mile, had, before the war, over eighteen per cent. of its area in permanent forest. Ontario, with some ten inhabitants to the square mile, has about five per cent. of its area in permanent forest. Similarly France, with 190 people to the square mile, has nearly one-fifth of its area in forest; Switzerland, with 235 persons to the square mile, has 23 per cent. in forest; Sweden is nearly one-half forest and Germany and Austria, respectively, one-quarter and one-third of their area in forest. The above seems sufficient reply to those who argue that the making of forest reserves will hinder the development of Canada.

---

*Extracts from Address by Mr. R. H. Campbell, Director of Forestry, before O.F.N.C., January 9, 1917.

The wood manufactures of this Dominion have a total yearly value of $177,000,000. In respect to capital invested, wages paid and cost of material they take first place, and the value of the product is one of the highest among the industries. Wood industries employ 110,000 employees, as compared with 66,000 for iron and steel, their nearest competitor.

In the present war wood is playing a great part. In the trenches it is used for walls, floors and braces. Behind the lines it is used for temporary buildings for the use of combatants and homeless non-combatants. For bridges, wharves and similar structures much is used and for replacing permanent structures destroyed by enemies it is indispensable. Wood cellulose is used for making a substitute for cotton for bandages, etc., crepe paper for slings and fibre board for splints. Paper clothing is worn to quite an extent in the Russian, Austrian and German armies, and in Austria paper is displacing many other textile products—from flour bags to twine. The chief products of the forest, in Canada, are lumber, wood for pulp, poles and railway ties.

In order to give the forest a chance to develop properly, it is necessary to ward off many injurious factors. Chief of these is fire. The average annual loss through forest fires in Canada is five million dollars, and it is estimated that two-thirds of Canada's forests have been burned over. Only seventeen per cent. of the forest area explored in the prairie provinces had been found to contain merchantable timber. The most important by far of the means of fire protection was the education of the inhabitants and frequenters of forest regions to guard against fire. After that, fire patrol, lookout stations, trails and various fire-fighting appliances had their places.

The forest must also be protected against insects and fungi. In British Columbia serious damage had been done to the western yellow pine by a bark-boring beetle. Poplar on Dominion lands had been much injured by a species of fungus, the chestnut in the United States had been almost exterminated by the chestnut tree blight, and a like fate was threatening the white pine of the east. The White Pine Blister Rust had obtained such a footing that much of the adult timber was threatened, and the planting of white pine put out of the question.

Improvements in forestry practice in the work of the Forestry Branch had been the marking of trees for removal, the disposal of brush after cutting and the study of natural regeneration and the natural mixture of species in the forest. The Forest Products Laboratories had also been established for the study of questions regarding the composition and characteristics of timber and the adapting of them to various uses.

F. W. H. J.

NOTES.

The Ottawa Humane Society held an exhibition during March at the Carnegie Library of over a thousand bird houses made by school children. Prizes were given to the exhibitor having the largest number of houses and the one exhibiting the best bird house. Several hundred bird houses were entered. There were many kinds, from little wren cottages of one room to large martin apartment houses big enough for twenty families. The houses were offered for sale and the proceeds, over $75.00, were given to the Red Cross. The boys of forty years ago robbed birds' nests, sometimes to make egg collections. Such exhibitions and competitions as this will do much not only to cure boys of robbing nests and to replace the collecting of eggs by the more valuable observation and study of birds, but also to attract and increase a bird population of great value to our food supply. The efforts of the Ottawa Field-Naturalists' Club, which resulted in placing bird houses at the Experimental Farm and in Rockcliffe Park, doubtless had an influence towards this present interest in bird conservation.

The reclamation of swamps is one of the most important problems of the present time. Many of the best lands are still in swamp form, and the sanitation produced if this land were reclaimed would more than pay for the work necessary, by the increased healthfulness of the country. The draining of the swamps is one of the best means of destroying the breeding places of the mosquito, and the extermination of the mosquito is one of the great issues of the day. It was this extermination that made the Panama Canal possible, and has rendered Havana a justly favored health resort.

Miss M. Young of the Mines Branch recently gave a demonstration of pottery making in relation to Mr. J. Keele's work on Canadian clays at the Red Cross meeting of the Women's Branch of the Civil Service, Ottawa. Miss Young has been using designs from prehistoric Canadian Indian pottery in the Museum of the Geological Survey, to develop art pottery distinct from that of the old world or the orient and appropriately Canadian. Some of the best English ware had its birth in the private studio. There is an open field here in Canada for the commercially interested and for the lover of beauty.

INDEX

TO

THE OTTAWA NATURALIST, VOL. XXX., 1916-1917

PAGE

Accipiter velox 97
Ablystoma Jeffersonianum 129
“ *punctatum* 129
Adopea (Pamphila) lineola 116
Alectoria jubata 19
Aluco pratincola 39
Algonquin Park, Birds observed in 125
Amelanchier florida 17
“ *Cusickii* 17
Antennaria fallax 142
Apocynum cannabinum 19
Arctostaphylos uva ursi 20
Arm structure of Crinoids and Cystids 69
Astur atricapillus atricapillus 16

Barn Owl nesting in southern Ontario 39
Bidens Beckii 143
Birds affected by artificial light 132
Bird Houses, My 155
Birds of Lake Onigamis Region, Que., and Algon-Park, Ont. 123
Bird Notes 26, 114, 132
Birds Observed at Grande Prairie, Peace River 157
Bird Records at Montreal 15
Blastoidocinus carchariaedens 24, 25
Bottom Environment of Marine Vertebrates of Western Nova Scotia, Notes on 149
Bombycilla garnula 16
Book Notices 68, 84, 116
Branta canadensis canadensis 15

PAGE

Brown, W. J., articles by 26, 97, 113
Bronzed Grackle, Racapity of 114
Burling, L. D., article by 53
Buteo borealis borealis 16
Calystegia spithamaeus 139
Campbell, R. H., Extracts from address by 158
Camassia esculenta 18
Cardamine parviflora 136
Caryocrinites ornatus 110
Cheneosaurus tolmanensis, a new genus and species of Trachodont Dinosaur from the Edmonton Cretaceous of Alberta 117
Chordata from Nova Scotia 153
Chrysanthemum Parthenium 143
Claytonia lanceolata 19
Coelenterata from Nova Scotia 150
Conium maculatum 139
Cornus paniculata 139
“ *stolonifera* 20
Conservation of Fish, Birds and Game 68
Comarocystites and *caryocrinites* 69, 85, 101
“ *obconicus* 105, 107
“ *shumardi* 101, 107
“ *punctatus* 73, 91
Cooper, J. M., article by 123
Correspondence 15
Council, Report of 1915-16 7
Council and Leaders at Excursions 2
Crayfishes, Concerning some Ontario 130

PAGE

Criddle, Stuart and Norman, article by 144
Crustacea from Nova Scotia 153
Cryptoglaux funerea richardsoni 16
Cystids with pinnuliferous free arms 69, 85, 101
Dendroica discolor 67
Dentaria laciniata 136
Diemictylus viridescens 129
Dowling, D. B., article by 11
Dracocephalum parviflorum 140
Echinodermata from Nova Scotia 152
Echium vulgare 140
Eriosateroidea 21, 40
Elatine americana 138
Entomological Soc. Ont., 46th An. Rep. 84
Eriocaulon articulatum 134
Erythronium grandiflorum 19
Eupatorium perfoliatum 142
European Butterfly found at London, Ont. 116
Excursions 14
Farley, F. L., article by 157
Felt, E. P., article by 37
Field, R.M., article by 29,47,58
Foerste, A. F., article by 69, 85, 101
Forests Vanishing, are our 158
Formation of the Great Plains of North Western Canada 11
Fossil Collecting, Notes on 21, 40
Gaultheria shallon 18
Geranium Bicknellii 138
Geum virginianum 138
Gratiola aurea 141
Grosbeak, Evening 26
“ Pine 26
Habenaria flava 135
“ *psycodes* 135

PAGE

Habenaria fimbriata 135
Halkett, Andrew, Report as Secretary O.F.N.C. 7
Harrington, W. H., article by 133
Hawk, Sharp-shinned 97
Hedeoma pulegiodes 140
Helianthus divaricatus 142
Hennessey, F. C., article by 114
Henslow's Sparrow, restricted breeding communities of 115
Hepatica acutiloba, aberration in 27
Hesperiphona vespertina vespertina 16
Horned Larks at Aweme, Man. 144
Hoyt Horned Lark 147
Hudson, Geo. H., article by 21, 40
Huntsman, A. G., article by 130
Insect Galls, American 37
Intraformational conglomerates and breccias, a preliminary paper on the origin and classification of 29, 47, 58
Isöetes echinospora 134
Junco hyemalis hyemalis 16
Kildeer Plover 113
Kindle, E. M., article by 149
Lambe, L. M., article by 117
Larus marinus 15
“ *philadelphia* 15
Lewisia rediviva 19
Le Lacheur, G., Report as Treasurer O.F.N.C. 10
Lilium parviflorum 19
Lobelia spicata 142
“ *Dortmanna* 142
Lonicera caerulea var. *villosa* 141
“ *oblongifolia* 141

PAGE

Magpie, in Western Ontario 15
Maya, Indian woman at Ottawa 148
Mediola virginiana 135
Members of O.F.N.C. 3
Mimulus moschatus 140
Molluscoidea from Nova Scotia 151
Musculum rosaceum fuligiosum 94
Mushrooms, edible and poisonous 84
Myosotis arvensis 139
Nature Guide Books 52
Nicotiana attenuata 20

Oberholsers Horned Lark 146
Onigamis, Birds observed at Lake 124
Ottawa District Plants, Notes on Some 133
Otocoris a. praticola 144
" " *enthymia* 146
" " *arctica* 147
" " *hoyti* 147
Oxyechus vociferus 113
Oyster shells at Mahone Bay, N.S. 148

Paedeumias and the Mesonacidae, with description of a new species 53
Paedeumais robsonensis 53
Pallid Horned Lark 147
Panax quinquefolium 138
Patch, C. L., article by 155
Pelecypoda from Nova Scotia 151
Penstemon hirsutus 140
Petasites palmatus 143
Pentremites conoideus 41
Pisidium latchfordi 95
" *subrotundum canadense* 96
" *vexum* 96

PAGE

Plants, Wild, use of, as food by Indians 17
Podostemum ceratophyllum 136
Porifera from Nova Scotia 150
Potentilla arguta 137
" *recta* 137
" *tridentata* 137
Pottery, Indian, from Roebuck, Ont. 148
Prairie Horned Lark 144
Prairie Warbler, nesting site for 67
Prince, E. E., article by 80
Protopalaeaster narrawayi 24
Prunus demissa 18
Pycnanthemum virginianum 140
Pyrola asarifolia 139
" " var. *incarnata* 139

Quahog shells at Mahone Bay, N.S. 148
Quiscalus q. aeneus 114

Ranunculus aquatilis var. *caespitosus* 136
Rhamnus Purshiana 20
Rhus canadensis 138
Ring-necked Pheasant 132
Rubus leucodermis 18
" *spectabilis* 18

Salamanders in captivity, notes on the feeding habits of 129
Sanson, N. B., note by 15
Saunders, W. E., articles by 15, 39, 67, 116
Sanicula trifoliata 139
Selaginella rupestris 134
Sea Squirts 80
Sheperdia canadensis 17
Solidaga latifolia 142
Sphæriidæ, new 93
Sphaerium torsum 95
Spiranthes lucida 136

PAGE

Spiranthes cernua........ 136

Sternberg, C. M., article by 129

Taverner, P. A., note by.. 123

Terrill, L. McI., articles by 15, 132

Thuja plicata 20

Treasurer's Statement, 1915-16 10

Trifolium arvense 138

PAGE

Triosteum perfoliatum.... 141

Verbasum Blattaria 140

Veronica arvensis 141

Vermes from Nova Scotia. 150

Viburnum pubescens 142

Victorin, Bro. M., article by 27

Water Powers of Manitoba, Saskatchewan & Alberta 116

Wilson, Tom, article by... 17

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& Medical
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